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Designing a touch screen game with children

Kids Play

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Abstract

Playing is an important part of the development of young children. The growth in number of touch screen devices owned by families has offered game designers an opportunity to create new kind of playing experiences also for young children. In order to design appealing games for children they should be included in the game design process. With age-appropriate methods the design process can be a fun activity for the participants and offer valuable results to support the design work.

This thesis describes a design process of a children's music genre game where children participated in one phase of designing the game. The game was built for the Apple iPad device. Altogether 52 children aged between 3 and 7 years participated in design workshops. The game was designed and tested together with these children by using age-appropriate co-creation and research methods. The workshop results were used for designing and developing the early stage prototype into a finalized product.

Literature study was conducted on children's cognitive development, children's different roles in design processes and methods where children are an essential part of the process. Based on the found material a detailed structure for sessions to be held in 5 day workshop was planned. Used methods included the Fun toolkit, Cooperative inquiry, Mixing ideas and Layered collaboration. Some changes to the original methods had to be made, because the available timespan was shorter and the participating children were partly younger than the ones the methods were created for.

The workshops initially provided qualitative and quantitative results which were analysed after the workshops. The most important benefit from organizing the workshops was to be able to "go inside" of children's minds. Observing them while they were playing and seeing what is interesting to them and makes them laugh was very important source of insight and inspiration. Based on this knowledge the following key game element themes were formed: abnormalities, achievements, funny failures, stardom / pretend play and surprises. These themes were used as the basis for further game design work. The overall game concept was reformed and new features were designed.

Keywords co-creation, participatory design, game design, Fun Toolkit, Cooperative Inquiry, Mixing Ideas, Layered Collaboration

This one is for you, Joel.

I would like to thank all of you cool kids Ahmed, Akseli, Alina, Allu, Anni, Anniina, Anttu, Arktos, Asha, Bella, Chloé, Daniel, Eeli, Elias, Ella, Elsa, Elsa, Emma, Feliks, Hilja, Inka, Ippu, Jasper, Julius, Jutta, Kaisa, Lenni, Lisette, Marja, Matti, Maura, Maya, Mikko, Mona, Neea, Niilo, Niilo, Okko, Oliver, Omar, Onni, Otava, Pihla, Romek, Ruut, Silja, Sumayo, Tomas, Tuure, Vilho, Vilho and Vilma.

Thanks also to all of you grown ups who helped me along the way.

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Children will play with anything that is available to them. Play includes learning, imagining, pretending, competing, discovering, socializing, and almost everything that kids do; they are just interested in what is enjoyable and fun, without noticing that they learn from playing. They may have more fun with pots, pans, and a wooden spoon, than the latest hot toy or game. In market sense, the words "toy" and "game" mean a plaything that an adult is willing to purchase, rather than just an item that a child wants to play with, which would include almost everything.

Brendan Doyle, head of Toy Lab at IDEO
(Moggridge 2007, p. 343)

1. Introduction

Playing is an important part of the development of young children. Now that touch screen devices are more commonly used in families more and more playing experiences comes from touch screen games. Ever since I became a father I have been interested about children's games. Especially iPad games seems to be very interesting to my 1,5 year-old son. As a concept designer I tend to view the games from a professional point of view and evaluate the quality of the interaction, graphics and other content. Even though there are thousands of games available for kids, it feels that there is a lot to improve in the quality of children's iPad games.

I haven't worked with children or designed a touch screen game before this thesis project. I like to challenge myself as a designer and explore new areas and learn new ways to work as a designer of digital products. I believe that in order to design good quality and appealing games for children they should be included in the game design process. With the use of right kind of methods the design process can be a fun activity for the participants and offer valuable results to be used in the design work.

Kids Play is a project where a music game for the iPad was designed together with children. Altogether 52 girls and boys from one kindergarten participated in design workshops. In the workshops age-appropriate co-creation and research methods were used for creating new ideas for the game. The workshop results were the basis for designing and developing the early stage game prototype into a finalized product.

The main design goal of this thesis was to find answers to the following questions:

What kind of design collaboration should be included in a design process when developing a touch screen game for young children?

What kinds of design and research methods are suitable when working with children?

What kind of results can be expected from design sessions when working with children and how these results can be used with the game development team?

The thesis includes a short literature study of similar projects in the field of children's interactive products, games and toys. Different design and research methods used in these projects are introduced. Based on these methods a structure for a set of design workshops for children was planned. The workshops were conducted during one week in one kindergarten. The goal of these workshops was to validate the game concept based on an early stage prototype and to gather feature ideas to be implemented in the finalized game. After the workshops the results were analyzed and a set of new feature suggestion and changes in the game concept were created within the game team.

In the introduction section I present the game project and the team behind it. Then I present few commercial case examples of interactive products, games and toys where children had an important role in the design process. Also a general view to children's music iPad games is presented.

Second section of the thesis addresses the methodology of participatory design with young children. A set of design and research methods is described. These were the basis for planning the game design workshop structure. Also some general level in-

formation about children's cognitive development stages and different roles in design processes is presented to better understand what kind of design and research methods would be suitable for the children based on their age. Even though Kids Play is a music genre game, music theory is not included in this thesis. The game team includes two talented musicians and issues related to music are their responsibility. Game music was tested in the design workshops and the testing method was created together with the team musicians.

Third section describes the structure of design workshops and the reasoning behind the selected methods. Also the validity of the planned workshop structure and used methods are evaluated. Then workshop results are presented and analyzed and it is described how the results were used in the end of the game design process.

In the final section I present the conclusions of this design project and future development ideas.

1.1 The game and team

Kids Play (used as a project name) is a game about music genres designed for children aged between 2 and 6 years. The player can explore different music genres and instruments used in jazz, surf rock, hip hop, electronic and Balkan beat music. The player controls a band of five animal characters by selecting which instruments to play and can interact the performance during the gig. The goal of the game is to explore and to get inspired by music.

Image 1. Game graphics and characters designed by Henna Luoma.

The game was designed together with 52 children aged 3 to 7 years from the kindergarten of Pajamäki in Helsinki, Finland. I used co-creation methods with them in a series of workshops to gather ideas for game features based on an early stage game prototype. The game character and instrument designs are mostly handmade from paper. It gives the game a unique look and feel. The game will be published in the Apple App Store and it will be distributed globally.

The game is crafted with an interdisciplinary team of five members from the fields

of digital media to textile design. My role in this game project is game designer and producer. I created the initial game concept and gathered the game team. I lead the game feature design and I'm also responsible to include the results from the children design workshops to the game design.

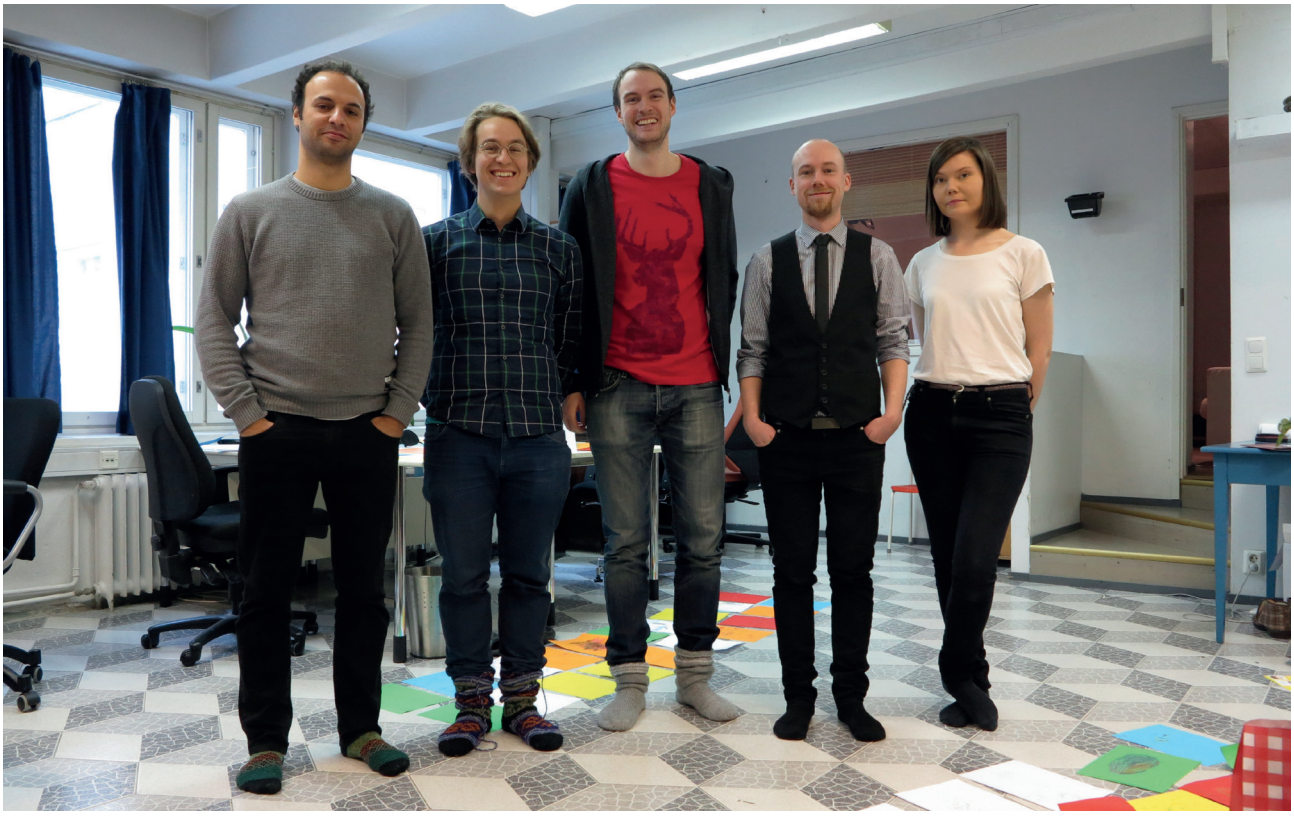


Image 2. The game team (from left to right): Gökce Taskan, Tuomas Ahva, Juha Salonen, Juha Vaaraniemi and Henna Luoma.

Other members of the game team are:

- Henna Luoma, game character and graphic designer
- Gökce Taskan, iOS developer
- Tuomas Ahva and Juha Vaaraniemi, music and sound designers.

1.2 Games and toys co-created with children

In this thesis co-creation is used as an umbrella term for discussing about participatory design and other methods which include the product's end users in the design process. Participatory design was initially called cooperative design and it origins from Scandinavia from the 1970's. The idea behind it was that users become full partners and works actively together in the cooperative system development process in different disciplines of the workplace environment (Greenbaum & Kyng 1991, p. ix). In this chapter I will present a few commercial cases where co-creation with children has been presented as an important factor for toy's or game's success.

Already in the mid-nineties *Purple Moon* was a company that developed interactive media for preteen girls. Brenda Laurel was one of the co-founders and the VP of design. She did a two-year research project to find out how to design computer games that would be interesting for girls. During the research about a thousand kids were interviewed. Laurel translated research findings into design principles for use in developing products for preteen girls. (Moggridge 2007, pp. 353-355)

The company launched in 1997 three interconnected businesses: interactive CD-ROMs, the purplemoon.com web site and a set of Purple Moon collectibles. The web site was the best success and it worked as a social platform for the players. In the end the company was acquired by *Mattel*. (Moggridge 2007, pp. 355-358)

More recent example of including children in the game design process is the way how *Microsoft* does game concept evaluation. Teams developing children's games create a lot of game ideas and concepts and before continuing any further with the concepts they test the ideas with target aged children. They do the evaluation through written game descriptions and game graphics in concept stage. (Hanna et al. 2004)

Children have been included also in the design of tangible toys and games. The world famous design company *IDEO* has one business line for designing toys and games for children. Brendan Doyle is the head of the *IDEO Toy Lab* at IDEO. The team creates a lot of game and toy concepts and tries to license the best ones to toy companies and manufacturers. (Moggridge 2007, pp. 336-337)

One of the most important part of the design process at IDEO Toy Lab is the Focus play group. The team commissions a new group of five to seven kids every six weeks. The team invites kids from this group to play with new prototypes once a week. The Focus play group consists also a couple of adults whom are asked questions about the new concepts from the parent point of view. (Moggridge 2007, p. 342)

Also *LEGO* has a long history in developing their products with their customers. They set up collaboration between designers and users during the early stages of projects—when designers and users co-create and validate each other's ideas. For *LEGO Mindstorms NXT* product line LEGO has leaded 3 ways of co-creation: expert user collaboration groups, social media networks and communities and events. (Naranjo-Bock 2011, Bell 2006)

LEGO has invested in also in open innovation through online communities. *LEGO CUUSO* is a platform that allows people to submit their ideas for new LEGO models. LEGO chooses the best ideas by their popularity, as ranked by all users of the platform. Those projects that get 10 000 votes or more are the ones that LEGO considers for further development. (Naranjo-Bock 2012)

Dibidogs is an animated TV series which is created by children. The characters, their planet and all the plots are originated from elementary school aged children. The first sketches and stories were created by 12-year-old Mikaela and her 10-year-old brother Tom during a family vacation road trip. Their idea was to create stories with other children around the world. They continued to create more characters after the vacation with their friends. In the end the children told the Dibidogs story to a screenwriter who created a storybook out of the children's creations. (Solatie 2009, pp. 76-79)

After a year the whole family travelled to China. During this stay more organized Dibidogs design sessions were organized with Finnish-Chinese families. In the end an animation studio from China created the Dibidogs as an 3D animation series. At the moment Dibidogs has been broadcasted in Finland and in China and the series has plenty of Dibidogs merchandise from books to mobile games. (Solatie 2009, pp. 76-79)

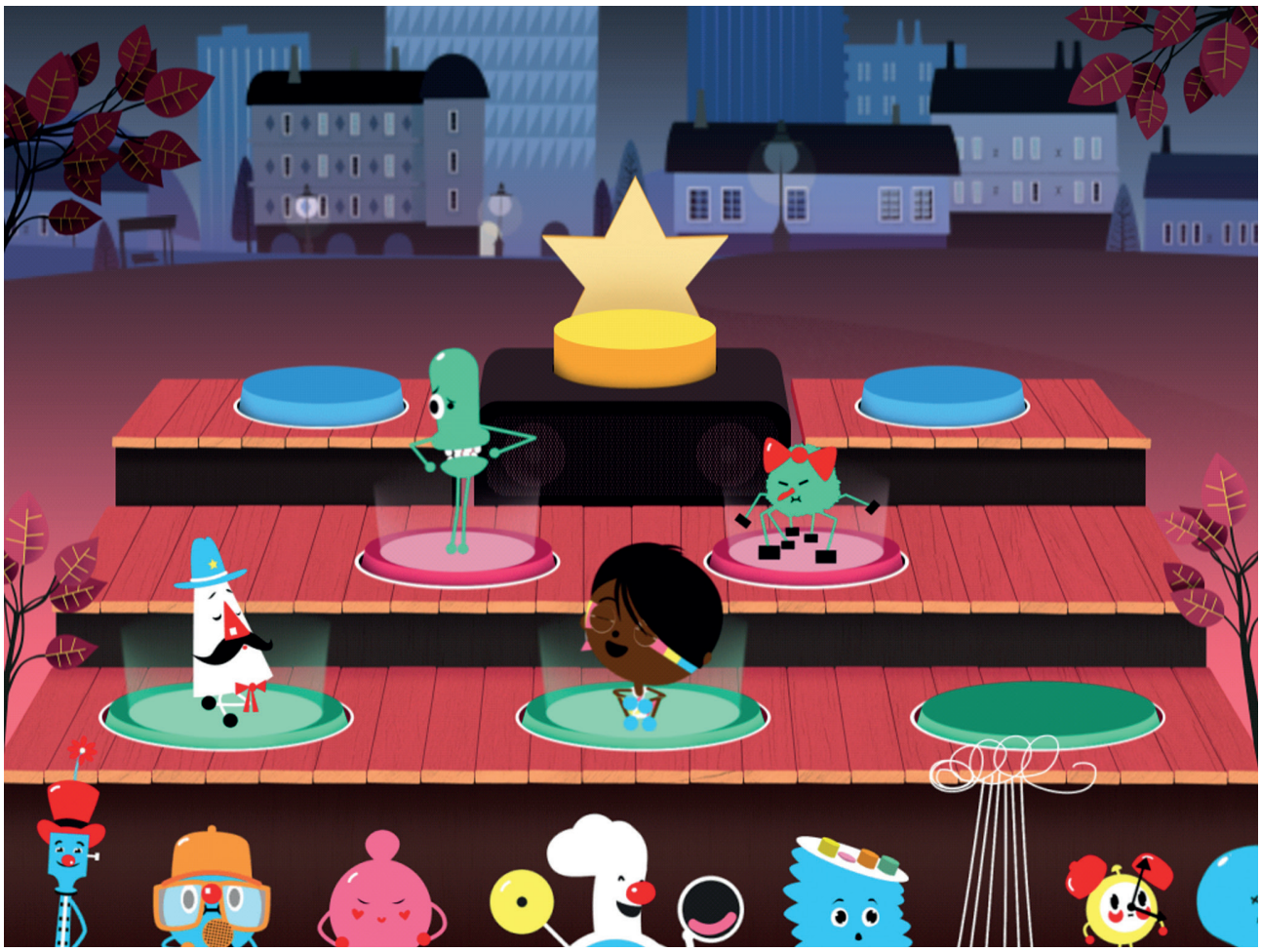


Image 3. Screenshot from Toca Band.

1.3 Children's games in the App Store

Kids Play will be published in the *Apple App Store* marketplace. This chapter presents some insight to the App Store and especially to the category of children's games. Also different type of children's music games are introduced.

Apple announced in January 2013 that the App Store has over 40 billion apps downloaded, with nearly 20 billion in 2012 alone. The App Store has over 500 million active accounts and it contains over 775,000 apps for iPhone, iPad and iPod touch devices. The app developers have been paid over seven billion dollars by Apple. (Apple 2013)

Children's games are scattered around in different categories in the App Store. Therefore it is difficult to find exact download numbers for children's games. To have some kind of reference to the market size of young children games, we can have a look at download amounts of one of the leading children's games publisher, or digital toys as they call their products, *Toca Boca* from Sweden. They have published 17 games for the iPhone and iPad, both free and paid, and in the beginning of the year 2013 their toys have been downloaded more than 29 million times in over 140 different countries (Toca Boca 2013a).

Toca Boca published a music game called *Toca Band* in the fall 2012. Toca Boca considers the Toca Band to be a digital toy, which to them means that it can be played and explored without any game rules or restrictions (Toca Boca 2013b). Toca Band has some similarities in the basic functions that was already designed to Kids Play when it was published. In Toca Band the player can select different kind of charac-

ters which presents some kind of an instrument. By selecting multiple characters the song has different kind of compilations. The player can also select a character to play a solo and then the player can interact with the character and play different sounds.

Because Toca Band has similar features as in Kids Play it was selected for comparative benchmarking. Toca Boca also includes children into their design process (Toca Boca 2013b). Benchmarking activities and results are described in the designing Kids Play with children chapter.

Wildchords by a Finnish game company *Ovelin* is an example of an educational music game. The goal of the game is to teach the player to play a real guitar by including game elements to the learning process. Wildchords is targeted to an older audience than Kids Play, but it is a good example of an educational music game.

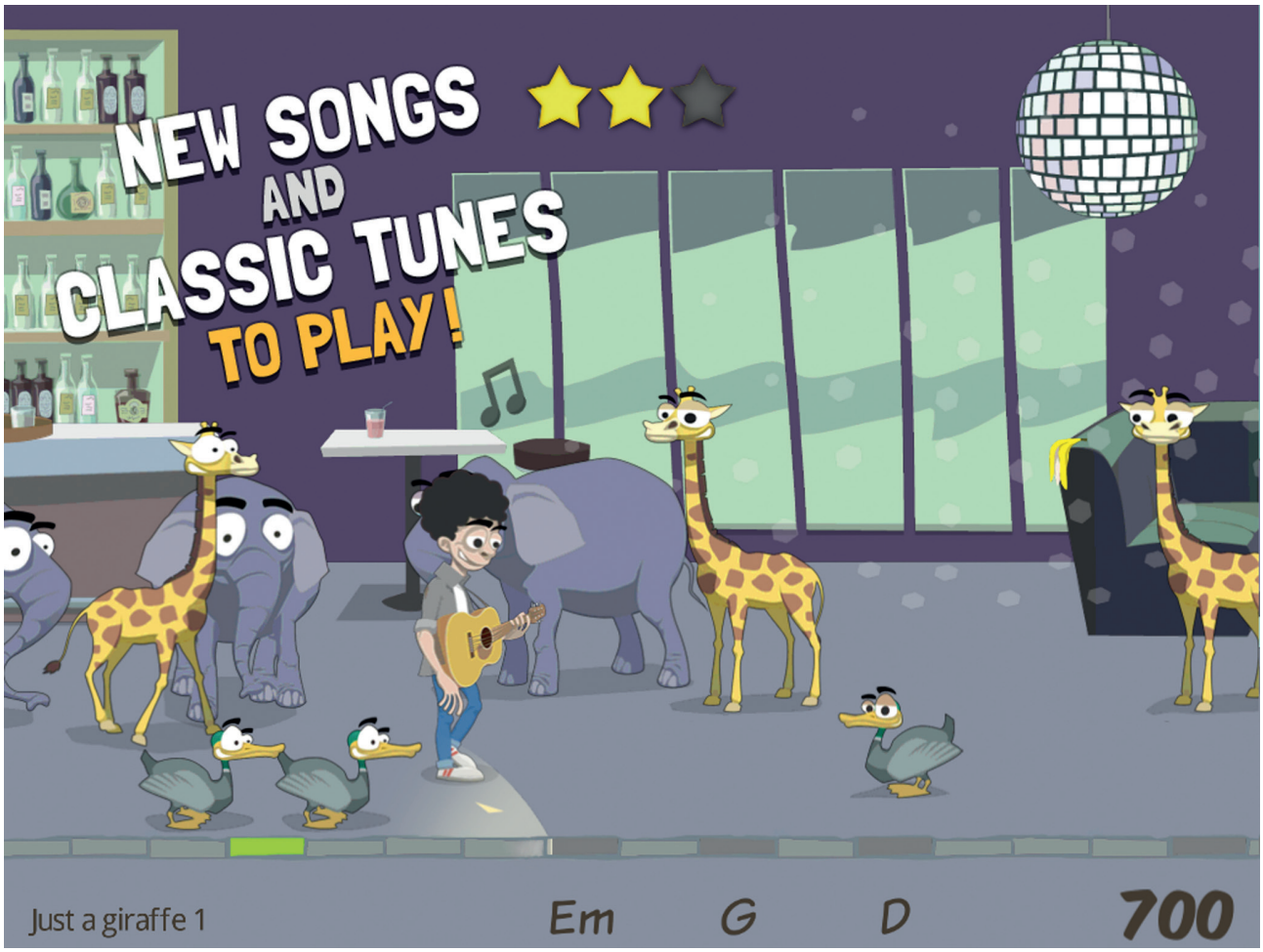


Image 4. Wildchords by Ovelin (Ovelin 2013).

Singing Fingers is an experimental and explorative music game made by Eric Rosenbaum and Jay Silver from *the MIT Media Lab's Lifelong Kindergarten* (Singing Fingers 2013). The game lets the player finger paint with sound and create all sorts of sound mixes and sound explorations through a simple hand painting interface.

When comparing these three different type of music games, Kids Play can be considered to have features which mostly refers to the entertainment category like Toca Band. On top of this it also has some educational aspects, because it will present different kind of music genres and instruments to the player.

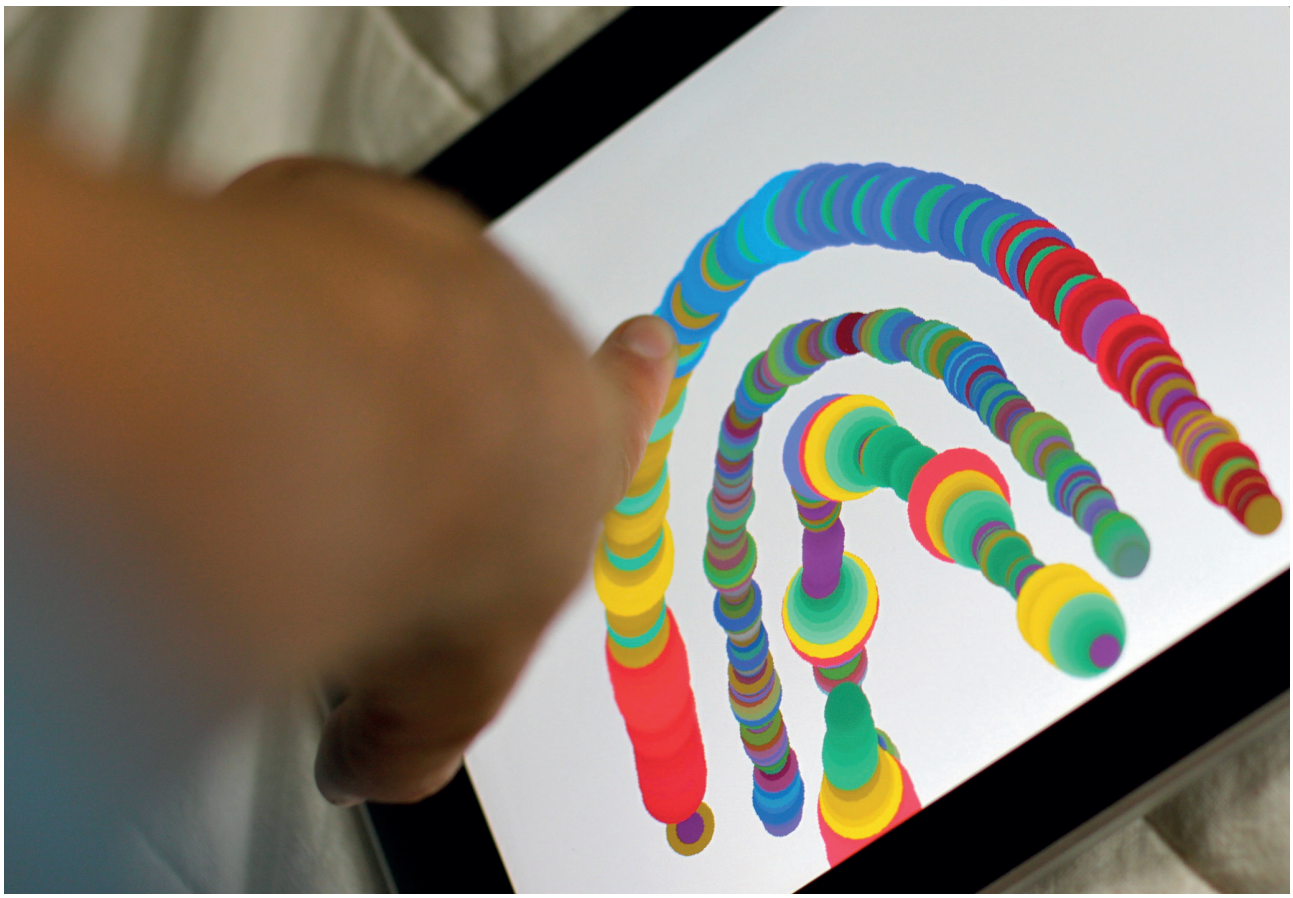


Image 5. Singing Fingers in action (Singing Fingers 2013).

Kids are comfortable with process-oriented activities that don't always have a clear and identified outcome. On the whole, adults tend to see matters in black and white and feel less comfortable conducting tasks that feel ambiguous. Kids, on the other hand, feel perfectly comfortable working in the "gray", which makes them ideal co-creation participants.

Jennifer Karsh, founder of Axen Research
(Karsh 2011, p. 120)

2. Designing interactive products for children with children

2.1 Children's cognitive development and the role of play

To design game content and interaction for children aged 2 to 6 it is important to understand the relevant cognitive and social development. Understanding the typical strategies of thinking and behavior for a certain age group is also very important when designing workshop content for children and evaluating suitable methods and techniques. This chapter presents an overview to children's cognitive development steps and how playing is linked to those steps.

Both Helen Bee (1999) and Ellen Wolock et al. (2006) build on Jean Piaget's (1896-1980) theories about children's cognitive development. Piaget divides children's cognitive development into 4 stages: sensorimotor, preoperational, concrete operational and formal operational. Although these claims have since been refuted, they can serve as broad descriptions of differing styles of play and thought between age groups.

Sensorimotor stage lasts from birth to 2,5 year of age. In this stage all learning is done via physical exploration of the environment. In the later portion of this period, the child begins to actively experiment and try out various actions and reactions in a more purposeful manner. By the end of this period, the child has acquired an initial set of concepts dealing with space, objects and causality. (Wolock et. al 2006, p. 5)

Preoperational stage is from 2,5 age to age 7. So from Kids Play's point of view this is the most important stage. Wolock et. al (2006, p. 5) writes that the major goals in this stage for a child is learning to speak and learning the idea that objects continue to exist even when they are out of sight. This is the first building block of memory and higher order thinking skills. Piaget also believed that children at this age fail to understand that the mass of an object is unchanged even when something is done to it. For example, if you take a short glass of milk and pour it into a taller, narrower glass, children in this stage will think that the taller glass contains more milk. Bee (1999, p. 174) also writes that the children in this stage are still very egocentric, meaning that a child assumes that everybody sees the world the way she does. Although newer research states that some children as young as 2 to 3 have some ability to understand that other people see things differently than they do. This comes up e.g. when they play and speak differently when playing with younger or older playmates.

When validating and selecting design methods for the workshops we need to consider the effect of egocentrism and how to avoid the negative effects of it in the design outcomes. Also it might be challenging to get the youngest children to work together as a group.

Piaget has two more stages, Concrete operational stage at ages 7-12 and Formal operational stage from ages 12-17. These are not relevant for our purposes.

Bee (1999, p. 173) states that children's cognitive development is built on children's playing activities. The way children play changes has some similarities to the Piaget's cognitive development stages.

Sensorimotor stage 0-2,5 years	Preoperational stage 2,5-7 years
• Babies initially think that objects out of sight aren't there, but later understand that the object doesn't really disappear (like in peek-a-boo). • Children learn through the direct manipulation of objects, using all senses (touch, taste, sound) • Children learn through the repetition of actions and imitation. • Children understand simple cause and effect.	• Children begin to represent experiences through play and communications. • Children are generally egocentric, less able to take another's perspective. • Children consider the current condition of what they see. For instance, a small banana cut into lots of little pieces is "more" than a big banana cut into just a few pieces. • In the early period of this stage, expressions may be taken literally, e.g. keep an eye on the ball.

Table 1. Concrete examples of child behavior according to Piaget's cognitive development stages (Wolock et. al 2006, pp. 5-6).

The stages Bee mentions are:

- Sensorimotor play
- Constructive play
- First pretend play
- Substitute pretend play
- Sociodramatic play

The first stage sensorimotor play lasts up to about 12 months of age. At that time it is normal that the children uses most of her playtime exploring and manipulating objects while putting things in her mouth, shaking them and moving them with all the coordination skills they have. (Bee 1999, p. 173)

The second stage, constructive play, starts when a children are around 2 years old. They start more and more to build and construct things like creating a tower from blocks or play with clay. Children aged 3 to 6 uses about half of their playtime with constructive play. (Bee 1999, p. 173)

Children start to pretend play also when they are around 1 years old. First the pretend playing is using a toy spoon or a comb to them selves. The actions are oriented to the self, but pretending is involved. After 15-21 months a shift occurs and children starts to do these same pretend play things to another persons or to a doll. (Bee 1999, p. 173)

Substitute pretend play begins when children are between 2 and 3 years of age. Children begin to use objects to stand for something else than the object is meant for. For example they comb doll's hair with a baby bottle and so on. By age 4 or 5 children spend about 20 % of their playtime by pretending like this. (Bee 1999, p. 173)

The last playing stage listed by Bee is sociodramatic play. This occurs during the preschool years. Children start to take roles while playing mummy and daddy or doctor and patient for example. Children act according to their roles and later also name the roles and give instructions to others playing the same role game. By the age of 4 virtually all children engage in some play of this type. It is also possible children with this age to form their own imaginary friends. (Bee 1999, p. 173)

2.2 Children's roles in design processes

This chapter describes what kind of different roles children can have when participating a design process. Also the role of children in the Kids Play project is described.

Druin (2002, p. 3) finds four main roles for children in design process: *user, tester, informant* and *design partner*. Her cases are about designing new technologies for children with children, from graphical interfaces to tangible products. Each design role has been defined based upon differences in how adults relate to children, in which stage of the design process children use the designed product of technology, and what goals researchers may have for the inquiries made with children.

One also must take into account the age and cognitive skills of the child taking part in a research project. It might be impossible to have a 2-year-old as a design partner so it might be wise to apply different and more suitable roles for different aged children in a research or a product development project.

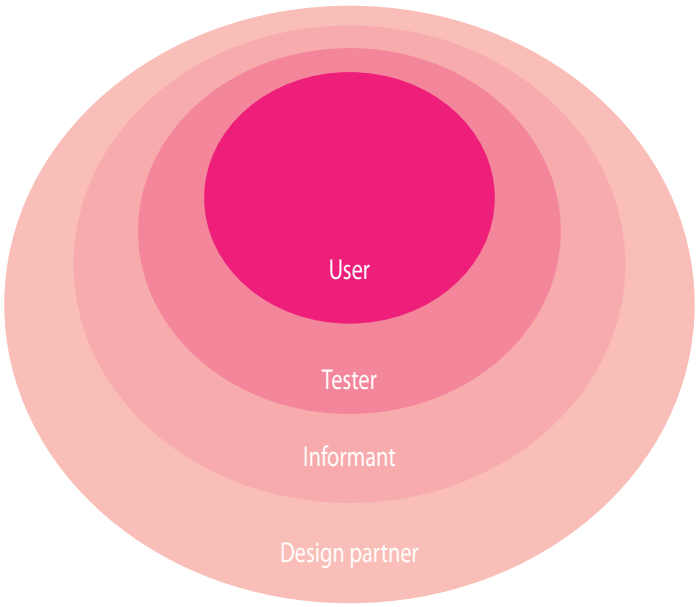


Image 6. Four roles that children may have in the design of new technologies (Druin 2002, p. 3).

In the role of user, children contribute to the research and development process by using technology, while adults may observe, videotape, or test for skills. Researchers use this role to try to understand the impact existing technologies have on child users. (Druin 2002, p. 4)

In the role of tester, children test prototypes of technology that have not been released to the world. As a tester, children are again observed with the technology and asked for their direct comments concerning their experiences. These results are used to change the way future iterations of the pre-released technology are developed. (Druin 2002, p. 4)

In the role of informant, children play a part in the design process at various stages, based on when researchers believe children can inform the design process. Before any technology is developed, children may be observed with existing technologies, or they may be asked for input on design sketches or low-tech prototypes. Once the technology is developed, children may again offer input and feedback. (Druin 2002, p. 4)

With the role of design partner, children are considered to be equal stakeholders in the design of new technologies throughout the entire experience. As partners, children contribute to the process in ways that are appropriate for children and the process. (Druin 2002, p. 4)

From the Kids Play project's point of view, children fall in the category of being informants. We already have built a game prototype based on our own ideas and we ask for input based on it. We have intentionally left some of the design choices open in the game prototype and we are prepared to change the overall game concept according to the workshop results. In addition to participatory designing we do a bit of testing with the children in the workshops so the role of testers is also applied. In order to move the design relationship to the design partner level, we would have needed to start including children in the very first design sessions. It might have turned out that in that case we would be building a totally different game at the moment.

2.3 Facilitating design workshops for children

When working with young children the design workshop content and setting needs to be adjusted to fit the cognitive level of the participants. This chapter presents a variety of tips and best practices found from literature about what to take into account when planning the design sessions.

Participants

The number of children needed during the design process can vary. It can depend on the designed product and available recourses (time and participants successfully recruited). If the prototype is still in its early stages, then a few children for a few hours can be all that is needed to spot the big problems (Druin 2002, p. 13). In many case stories it was advised that one adult can handle a group of three children (Guha et al. 2004, Walsh 2009, Walsh et al. 2010). Also it is a good idea to have friends in the same group. This will help to keep the discussion more relaxed.

Children ages 7 to 10 years are claimed to be the most effective prototyping partners (Druin 1999). The participants of our workshops are younger. Naranjo-Bock (2012) writes about children aged 3 to 6 years that conducting a co-design session with this age group is especially challenging because of the children's developmental stage. For children of this age, more than any other, it is important to invite parents or teachers to the sessions, because they can help you to fully understand what the children are saying, doing, or making and can provide greater context.

Time and space

When planning the schedule for design workshops you need to consider the age of the participants. According to Naranjo-Bock (2012) and Karsh (2011, p. 120) a design session should last for 1 to 3 hours. This feels to be a bit too much for our participants. Also the kindergarten teachers whose daycare groups are participating to the design sessions said that about 45 minutes will be the maximum time the children can concentrate on one thing.

The design workshops should be conducted on-site in a place where children feel at ease. This generally means going to wherever children are, whether at school or at home. Sessions should take place in a room with plenty of space in which children can move around and have easy access to materials they can freely use in creating

things. (Naranjo-Bock 2012, Karsh 2011, p. 120)

Communication and interviewing

In the beginning of a design session you need to clearly explain your research project to all participants and their caregivers, as well as what you'll do with the data that you obtain. It is important to communicate clearly that you will not use all of their ideas and that most ideas get transformed radically during the design process (Naranjo-Bock 2012). One way of explaining this is to use a metaphora a child understands. For example Guha et al. (2004) explained designing as baking cookies to the kids so they could understand why the ideas are mixed. Each cookie ingredient on its own may not taste good, but once all of the ingredients are combined, you get a tasty product that is better than each individual ingredient.

When doing interviews, children are extremely honest in their feedback and comments concerning technology, but much of what they say may be in their actions. Therefore the results needs to be interpreted within the context of concrete experiences (Druin 2002, p. 2). According to game concept evaluation conducted by Microsoft, children often stick to what is familiar when trying to verbalize redesign (Hanna et al. 2004, pp. 53-54). Therefore interviewed children offered suggestions that were based on other games they had been playing recently. Suggestions for improvements may be more appropriately generated by observing children and listening to comments about what they like and dislike. Observing interaction with favorite games may be more useful for later product development than to compare user interfaces and usability of specific design features.

Hanna et al. (2004, pp. 55-56) also presents a list of guidelines how to conduct interviews with children when evaluating game concepts at Microsoft:

- Invite children in pairs of good friends.
- Read aloud simple descriptions of concepts and get children to rank them before observing any related art.
- Allow children to interact with any onscreen presentations as a pair and without an observer present to facilitate discussion.
- Ask children to re-rank concepts after viewing art and discuss their likes and dislikes in the pictures.
- Avoid specific questions about improvements in art style or gameplay.
- Avoid ratings of abstract or predicted game attributes.
- Ask children to work together while viewing onscreen presentations (either cycle through together on one computer or come to agreement about the best concept).
- Add paired-comparison rankings (which of each pair they like better) to support overall ranking.
- Focus comparison to favorite games on similar genres as the new concepts.

Documentation

Literature offers a variety of ways and techniques to document the design session results. Techniques vary method by method, but in most of the cases children documented their own ideas by drawing and crafts. Also the concept of keeping a research journal by the children was introduced (Guha et al. 2004, Walsh 2009). For the designers or researchers different kind of formats for writing down notes during the design sessions are introduced in the following chapters.

Druin (1999, pp. 594-595) noted that documenting their design sessions with video wasn't successful because often when children see a video camera in the room, they tend to perform to the camera. Also placing the cameras in public spaces can be difficult, because it is unknown where children would sit, stand, or move in their own environment. This problem of course depends on the space.

2.4 Design and research methods for working with children

The following chapters presents examples of designing interactive products with children and the methods used in these projects. The methods are described on a detailed level because the content of the game design workshops will be planned based on these methods. Most of the described methods are targeted mainly for older children than our focus group. This is one factor that needed to be evaluated when selecting suitable methods for the design workshops.

2.4.1 Cooperative Inquiry

Cooperative inquiry is a design research process that tries to enable young children to have a voice throughout the whole design process. It was originally developed at the University of Maryland for developing new technologies for children with children as research partners. The goal in developing cooperative inquiry was to find techniques that can support intergenerational design teams in understanding what children as technology users do now and in the future. The method is based on HCI research and theories of cooperative design, participatory design, contextual inquiry, activity theory and situated action with modifications in order to get children more involved in the process. (Druin 1999, pp. 592-593)

Cooperative inquiry includes three main methods which are modified to suite children as design partners (Druin 1999, p. 594-596):

1. Contextual inquiry

- Contextual inquiry enables to first explore numerous ideas through observation of users.
- Group of children and adults observe the behavior of users and collect data in the users own environment as equal research partners.
- Both create notes, the children draw and adults write.
- It was found beneficial to have a separate adult to write the notes and another to act as an interactor, who would initiate discussion and asked questions concerning the activity from the children.
- The adults need to act as peer researchers with the children by not having an adult-children power structure and the adults should highlight this by wearing informal clothing.

2. Participatory design

- From the results of contextual inquiry one found area of interest is selected for more in depth research with participatory design prototyping. Low-tech prototyping is an effective design tool when done together with contextual inquiry.

RAW DATA:			DATA ANALYSIS:		
Time	**Quotes**	**Activities**	**Activity Patterns**	**Roles**	**Design Ideas**
39:20	"I want the playing one."	Child clicks on the scared cat and tries to take out another one. It doesn't work.	Difficulty with mouse dragging.		Look for alternative input devices or don't use dragging with a mouse.
39:50	"Awww. The kitten was afraid."	Child clicks on another basket with a cat.	Tells stories about actions on screen.	Storyteller	Offer children storytelling opportunities with technology.
40:20	"Which one's the playful one?"	Child looks for a playful cat.	Child knows what she likes.	Searcher	
41:00	"I don't want to name my kitty."	Child doesn't name her cat when prompted to by the computer.	Child knows what she likes.		
41:30	"That's to give milk."	Child clicks on different icons to see what they do.	Tests out what can be done.	Explorer	Make technology easy to explore.

Table 2. Example of a contextual inquiry diagram (Druin 1999, p. 595).

Based on design ideas that have emerged from contextual inquiry notes, prototyping can focus discussion and be a bridge for collaborative brainstorming activities.

- Children ages 7-10 years old are the most effective prototyping partners. These children are verbal and self-reflective enough to discuss what they are thinking. They can understand the abstract idea of designing something with low-tech prototyping tools and they don't seem to be too worried about how things "are supposed to be" like bit older children are.
- Adults in the group need to be involved in the prototyping as equal design partners. Not leading too much or letting the children do all the work.

3. Technology immersion

- By establishing a technology-rich, time-intensive environment for children, the observation techniques of contextual inquiry can be used to capture many activity patterns that might otherwise be overlooked.
- With technology immersion, it is critical that children not only have access to technology in a concentrated way, but are also decision makers about what they do in that environment. Children must be asked to make their own choices when using different kinds of technology.

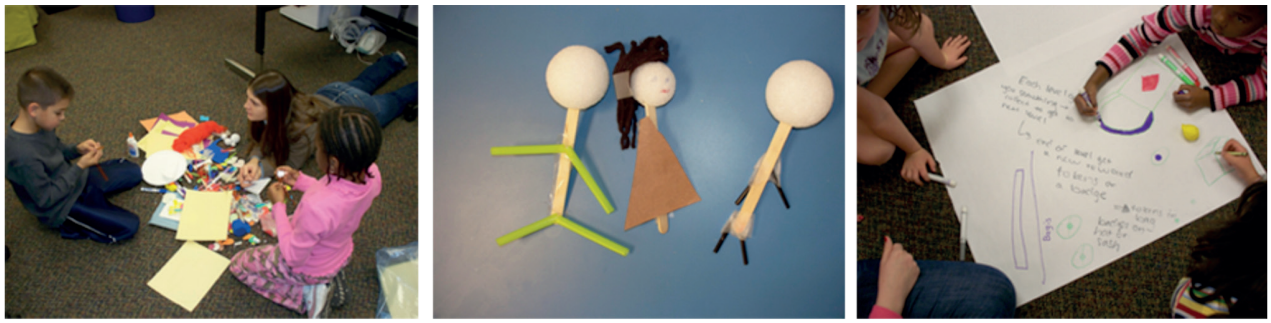


Image 7. Examples of low-tech prototyping process (Walsh 2009, p. 5).

Walsh (2009) writes how cooperative inquiry was used as the design process in a multi-day, co-design session at the University of Maryland's Human-Computer Interaction Lab. The goal of the sessions was to design an instructional game that leveraged the Nintendo Wii's motion controls to teach about U.S. National Parks and historical events. The game was intended for Children with attention deficit disorder (ADHD) and others who are kinesthetic learners.

The design group included nine children, ages 7 to 11 years old and both boys and girls. Cooperative inquiry as a method relies on adults and children working together

as design partners to create low-tech prototypes. Those prototypes are redesigned iteratively until they are implemented into a high-tech prototype. That prototype then receives feedback from the design partners and an iterative cycle continues. The children participate in the design of the technology throughout its life cycle. (Walsh 2009, p. 2)

The design sessions were held during three days. Here's a summary of the design session contents. (Walsh 2009, pp. 2-3)

Day 1

- Participants were divided into pairs based on perceived age and gender.
- The pairs took turns playing Wii Sports on the video game system about 10 minutes to get to know its controls. They were video recorded while playing the Wii to get material for analysis.
- When not playing with the Wii, the participants wrote in their journals about their favorite video games.
- After playing a feedback session was held where all positive and negative experiences and ideas were collected to a wall with post-it notes. In the end the notes were grouped into categories and the session ended with a final debrief discussion.

Day 2

- The participants were grouped into three teams, with a minimum of two children and one adult per team.
- The teams' goal was to design their own instructional video games using low-tech prototyping techniques.
- After the low-tech prototyping session, the participants met to discuss each other's ideas. Summaries of each game were written on the white board and common trends in participants' ideas were identified.

Day 3

- The participants were placed into same groups as day 2 with different adult partners and used Mixing Ideas (introduced in following chapter) as the main method of design.
- Each team worked on combining their ideas into one cohesive idea that would be presented to the larger group.
- Once the teams presented, the common trends were identified and the group began to come up with one design for an instructional video game.

After these first sessions the next step is to create a low-tech prototype in the form of storyboards and paper prototype based on the children's designs. After this an interactive prototype will be built. (Walsh 2009, p. 5)

2.4.2 Mixing Ideas

The mixing ideas is an additional Cooperative inquiry design technique used to foster effective collaboration with young children (ages 4-6) as Cooperative inquiry targets a bit older children (ages 7-10). It was developed by *Classroom of the Future* research

group at the University of Maryland. The mixing ideas technique is a framework for merging individual ideas into bigger, collaborative ideas. (Guha et al. 2004, pp. 35-36)

The concept of building upon each other's ideas in an elaborative brainstorming process appears difficult to understand for young children. It can be difficult for them to combine their own personal idea with another person's to generate a completely new idea. According to Piaget's stage theory of development, children at the preoperational stage of development, ages approximately 2-6, are still egocentric. When creating new ideas based on kids' own ideas and creating one bigger collaborative idea or concept, young children can feel that their own idea is lost from the final result. The mixing ideas method tries to solve this problem. (Guha et al. 2004, p. 36)

The mixing ideas method was created while the research group was designing a new concept for center time, which is a daycare activity where the room is divided into different activity centers (e.g. building with blocks, costume play, computer time). In the beginning the group of design partner kids was divided into groups of three. The groups were formed so that the kids with good chemistry were in the same group. (Guha et al. 2004, p. 37)

The mixing ideas method contains three stages: *individual idea generation, initial mixing of ideas* and *mixing the big idea*. (Guha et al. 2004, pp. 37-39)

Individual idea generation

- Each child first observes the design problem with the help of an adult. The idea is to look how things are or work at the moment and then improve the situation (looking at children playing during a center time).
- All observations are drawn on children's "research journal" and the adults annotated in words what the children were observing. The adults should write down only what the child explained and to encourage the child to have lots of ideas in a brainstorming fashion where the ultimate feasibility of the ideas was not an issue.
- After the children drew what they saw, they are asked to draw ways to make the situation better (how the centers could be better). The kids were explained that they would later combine these ideas with the others in their small group to come up with even better ideas.

Initial mixing of ideas

- The children mix their ideas within their small groups. At the beginning of each session, the children's journals are showed to the group with their individual ideas from the previous session and the kids explain the ideas to others.
- The researchers explained this step as baking cookies to the kids so they could understand why the ideas are mixed. Each cookie ingredient on its own may not taste good, but once all of the ingredients are combined, you get a tasty product that is better than each individual ingredient.
- The kids were asked to imagine how all the ideas would be mixed inside of a mixing bowl like cookie do. After that the children and adults talked about possible ways to mix ideas. In the end the group draw the mixed ideas on table-size pieces of paper using magic markers and created a name for their collaborative idea (the center name).
- If needed the same mixing process is conducted again to combine ideas from two groups the group in order to reduce the amount of ideas before the final mix of the big idea.

Mixing the big idea

- When the mixing groups get larger the role of adults gets more important to give more structure to the mixing session.
- Before the mixing with the children the adults need to think possible outcomes and ways to mix the final set of ideas. This is not for telling the children how the mixing should happen, rather, this offers the researches possible roadmaps in preparation for the final mixing session.
- In the beginning of the session the children explained their ideas in order to remind them of their ideas and to enable them to assume ownership of their ideas.
- The drawn ideas were cut into little manageable pictures and the children rearrange them and put them together with tape as a way to begin thinking of how their ideas could fit together. In this way the children are able to physically manipulate their idea and the ideas of others.
- After this the children are offered a new large piece of paper in order to draw one big, final idea.

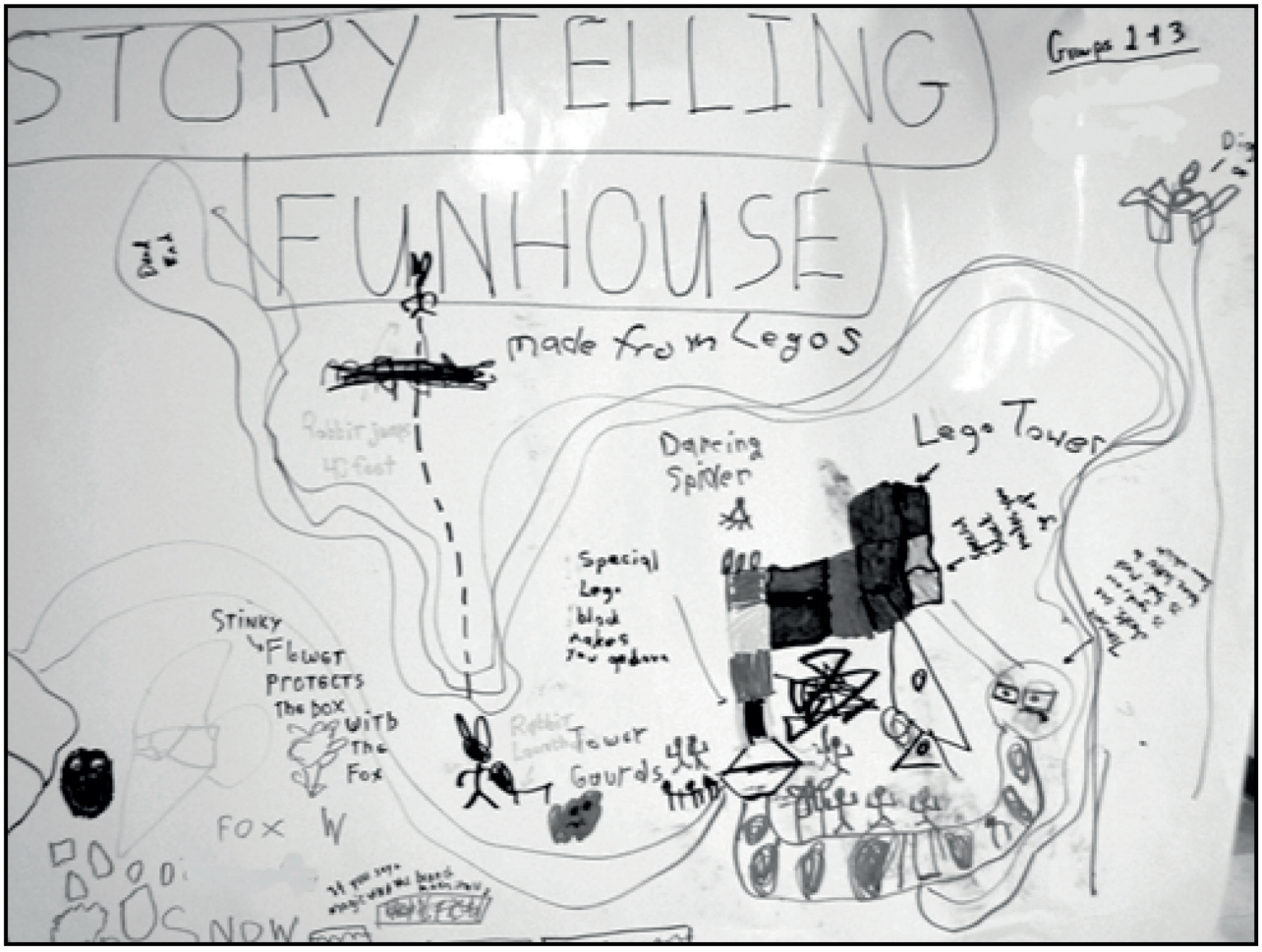


Image 8. Mixing ideas from two groups (Guha et al. 2004, p. 39).

These individual stages are important as they spark imagination and innovation in children and adults. Although one child's specific individual idea may not be immediately apparent in the final idea, through the process of having that thought and the elaboration that occurred, each child and adult truly has had influence on the final big idea. (Guha et al. 2004, p. 40)

Guha et al. (2004, pp. 40-41) lists the following lessons learned from using mixing ideas method:

- Young children need more structure to collaborate during the brainstorming process.
- It is important that each person feels they contributed their ideas.
- Drawing is an important bridge for young children to mix ideas.
- Physically cutting and pasting offers another bridge for idea mixing.
- One-on-one work between adults and children is an important part of the team process.
- Adults need to remember to facilitate the mixing of ideas.

2.4.3 Layered Elaboration

Layered Elaboration method was created by a research group at the University of Maryland. It has been used and modified while designing instructional games for children. The concept for Layered Elaboration has its roots in storyboarding for interactive media, paper prototyping, and annotation tools. It was created on the basis of the Cooperative Inquiry method in order to better meet the design challenges of todays children who are more and more familiar with new technology and mobile devices. (Walsh et al. 2010)

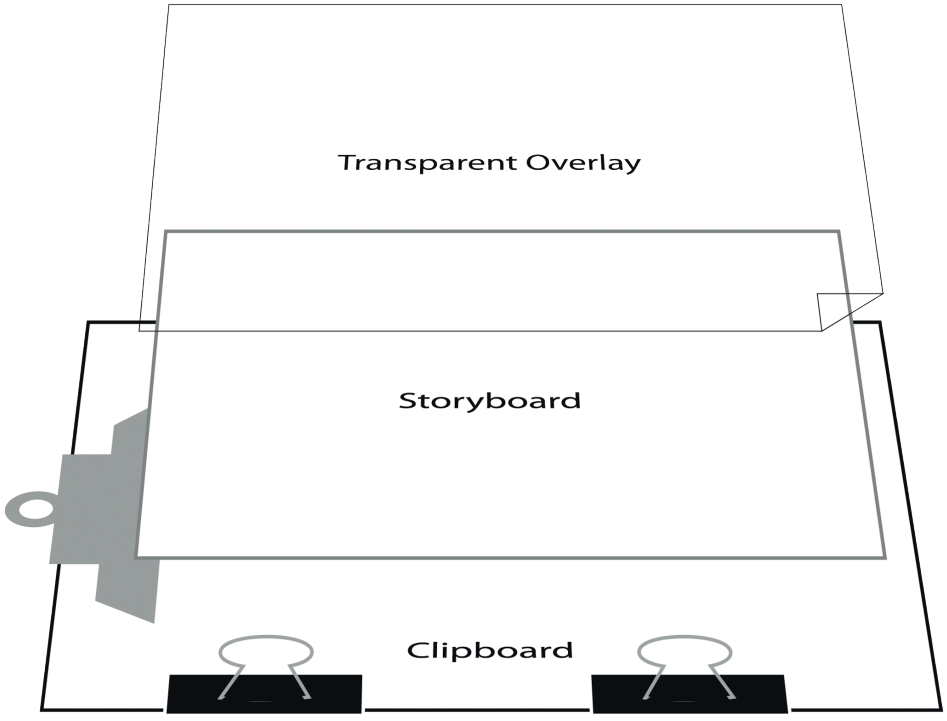


Image 9. Illustration of a Layered Elaboration clipboard and stack order of materials (Walsh et al. 2010).

Layered Elaboration allows design teams to generate ideas through an iterative process in which each version leaves prior ideas intact while extending concepts. The process is partly similar as in Mixing Ideas. The main steps are (Walsh et al. 2010):

- The participants are divided into groups of one adult and two to three child design partners.
- Each team was given drawing paper and markers to create a design to solve one of the presented problems. The groups were assigned a topic and given fifteen minutes to create their designs.
- Every team explains their initial design and answers questions in a "stand-up

meeting" in the middle of the room.

- A transparent overlay with registration points is added on top of each initial design. The designs are exchanged among the groups.
- The groups began elaborating on the ideas presented in the initial designs. By using the transparent overlay and markers, the design partners are able to draw on the previous group's work without permanently destroying it.
- After 10 minutes the groups has another stand-up meeting where they explain their additions to the initial designs. After the meeting a new transparent overlay is added on top of each design and a new round begins.
- After the final design period, all of the groups discuss the final designs. All ideas from the design partners are identified and written on the white board.

The method has the following set of strengths according to Walsh et al. (2010):

- The ability to add to and modify the storyboard without permanently damaging it.
- The ability of the design team to stack the transparency overlays over the original storyboard to see common trends in the different groups' feedback.
- The portability as a co-design tool. Instead of needing a large physical space for low-tech prototyping, the stackable storyboards are no larger than a clipboard.
- The relatively rapid, iterative nature of the technique allows a number of design partners to provide input and ideas in a short amount of time.
- The cost of the materials is low.

2.4.4 Drawing methods

Nicol and Hornecker from the University of Strathclyde have used drawing as a communication method with young children aged between 5 and 12. They conducted a user evaluation of early prototypes of digital installations, mostly interacted via a touch screen, prior to their deployment in a new national heritage museum of Robert Burns Birthplace Museum in Alloway, Scotland. According to them their study indicates that using the drawings method to elicit responses in an interview situation is an effective methodology for performing an evaluation of early prototypes of a system designed for museum entertainment. Drawings provided useful insight into what children had focused on in the games and how they experienced the gameplay. (Nicol & Hornecker 2012)

First the children were asked to play with the prototypes with their parents and other members of their study groups. After that the children under 12 were given drawing material and they were asked to draw themselves playing the games. After drawing the children were interviewed. Nicol and Hornecker used features of the drawings as a way into interviewing the children and understanding their experience while playing the game: what they had understood, misunderstood, liked or disliked about the games and how they thought they had interacted with others. (Nicol & Hornecker 2012, p. 278)

They state that using the drawings as the starting point of the interview meant they could focus on what was important to the child and gain their trust in talking about something personal to them, and they were proud to show what they had created. On top of the interviews the drawings were analyzed. For example in 27 of the 38 drawings analyzed, children drew themselves smiling, which is an indicator of them enjoying the games. (Nicol & Hornecker 2012, p. 278)

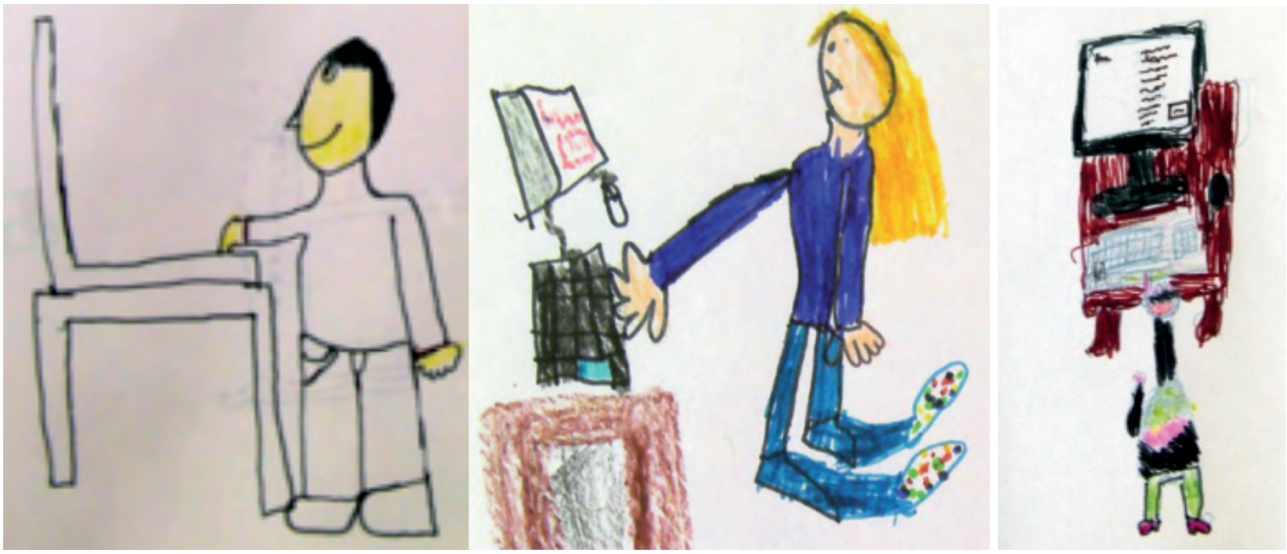


Image 10. Drawings from the children of themselves playing the game prototypes (Nicol & Hornecker 2012, p. 278).

The interviews began by asking children to show their drawing and explain what they had drawn, sometimes pointing to specific elements to ask what they represented. Children generally talked freely about what they had drawn. Once children had begun talking about their drawings, it was easy to move on to questions about other issues such as how to improve the games. Some children even drew their suggested improvements. The drawings were also useful in keeping children focused on the interview. (Nicol & Hornecker 2012, pp. 278-279)

Xu et al. (2009) from the University of Central Lancashire, UK have also used drawings as a tool for the evaluation of children's tangible interfaces. Compared to Nicol's and Hornecker's study Xu et al. have more emphasis on the quantification and coding of the drawings. This is important if the goal is to compare multiple products or versions of the same interface.

Element	Evidence	Score
Fun (F)	**Smiling, words –** *e.g. smiling, 'cool!' sun, happy colour scheme*	Absent (0) Present (1)
Goal fit (GF)	**Amount of the user control –** *e.g. flashing lights, music…* **Amount of competition –** *e.g. words, scores, happiness vs. sadness*	Not evident (0) Possibly evident (1)
Tangible magic (TM)	**Feel of the interface -** *e.g. size of the racket, connectedness to the board* **Smartness of the interface –** *e.g. music manipulatives on the board*	Evident (2) Highly evident (3)

Table 3. Example of the coding in Xu et al.'s drawing method (Xu et al. 2009, p. 268).

First the children were introduced to the evaluated games and right after playing the games the children drew about the games. Adult observer could chat with the kids while they were drawing and make annotations to the drawings to clarify what they presented. After this session a group of four adult evaluators went through all the drawings and coded their findings. They used three usability and UX factors: fun, goal fit and tangible magic. Fun is rating for did the player enjoyed the game or not,

goal fit rates if the goal and interaction of the game was evident and the tangible magic evaluates if the tangible nature of the interface gave something extra to the overall user experience. (Xu et al. 2009, pp. 267-268)

Xu et al. also found the drawing method to convey useful information when evaluating children's tangible interfaces and designing new technology. They write that as an extension of this scheme would be to incorporate other UX and usability elements into it. This would expand the method for evaluating and coding other aspects of children's drawings. (Xu et al. 2009, p. 269)

2.4.5 Fun Toolkit

Fun Toolkit is a set of tools for gathering opinions in child computer interaction and user experience. It was developed by Read and MacFarlane from the University of Central Lancs, UK. The toolkit in its current form contains three tools that can be used with children to pass opinions on products: *the Smileyometer, the Fun Sorter and the Again Again table*. (Read 2008, p. 119)

Image 11. The Smileyometer scale (Sim & Horton 2012, p. 71).

The Smileyometer is a child-friendly 1 to 5 Likert scale for expressing feelings about a product. It can be used before and after the child experiences the tested product. By using it before, a measure of the expectations of the child can be gathered. Using it after experiencing the product, the child is assumed to be reporting experienced feelings or experienced fun. If several products are being evaluated at the same time, the preferred use of the Smileyometer is to show a single one at a time for each product. (Read 2008, p. 122)

The Fun Sorter is used to compare a set of related technologies or products. For example the kids would rank a game based upon the different constructs (question) created in the Fun Sorter and selecting which was the best and which was the worst. It is recommended that, especially for younger children (<8 or 9), each construct be presented individually. (Read 2008, pp. 122-123)


Fun Sorter

Which game was...

Question	Best	Worst
Most Fun	g	M
Easiest to Play	M	g

Image 12. The Fun Sorter example (Sim & Horton 2012, p. 71).

Image 13. The Again Again table example (Sim & Horton 2012, p. 71).

The Again Again table is a simple table that requires the child to tick either 'yes', 'maybe' or 'no' for each activity or product, by answering the question 'Would you like to do this again?' The idea for this tool comes from work in psychology that supports the idea that we most likely want to return to an activity that we have liked. It is most useful where three or more products or activities are being compared. The cognitive load in the Again Again table is less than in a Fun Sorter as the child is comparing each product on its own merits and is not being required to rank them one against another. This makes the tool especially well suited to the younger children. (Read 2008, pp. 123-124)

Sim and Horton (2012) used the Fun Toolkit to evaluate user experience between two computer games. First a picture of the first game was shown and the child was asked to complete the first Smileyometer to measure the expectations of the game before playing. After the game was played the second Smileyometer test was taken and the rest of the tests in the Fun Toolkit. Then the same procedure was conducted for the second game. In the end the results were analyzed and displayed in tables. The results showed which game was better according to its overall user experience.

Games are an interesting category. I like designing games because they are all about social interaction. You are getting kids together, or families together, not in the front of the TV, but in the family room, sitting round a table or on the floor. That's kind of a wonderful feeling.

Brendan Doyle, head of IDEO Toy Lab
(Moggridge 2007, p. 349)

3. Designing Kids Play with children

3.1 Co-creation workshops

When I started to plan the design workshops I really didn't knew what kind of results could be expected. I had no previous experience from designing with children. The main goal for the workshops was to get feedback and new feature ideas based on the game prototype - does the game appeal the designed target audience and how could we make the game experience better?

One concrete design goal was to get ideas and sketches from the children for creating the last band member character. We also expected to get some insight about the game mechanics and interaction like rewarding and feedback loops. We got a lot of material from the children that mostly focused on small improvements based on the game prototype's graphics and characters. The most important thing the workshops offered to us was to have a look into 3 to 7 year-olds world, their thinking and behavior. What do they like and what makes them laugh. This insight and made observations worked as an important part of the game design process.

The following chapters describe the whole conducted design process from designing the workshops to analyzing results and ideas for future improvement.

3.1.1 Game prototype

An early prototype for Kids Play game was built for the design workshops. The prototype was used as basis for interviewing the children and the design work. The prototype was also evaluated against Toca Band, which is a game from the same children's music game category (described in the introduction chapter).

The prototype included the core features that were designed before the workshops. In the prototype the player controls a band with four members. Each member can play certain instruments depending the venue where they are performing. The prototype included the Balkan beat venue. In the venue the player can select an instrument to play by dragging it to the correct character with multitouch enabled. This triggers the selected instrument's music track to play. After adding other instruments the song starts to compose itself. On top of the original Balkan beat instruments the player can select to add alternative instruments from another music genre. In the prototype the alternative instruments were from electronic music genre. The song is looped and the player can let the characters play as long as she wants.

We had designed other features that were not implemented in the prototype before the workshops. We wanted to get the results from the workshops before going further with the detailed game design and implementation. Here is a list of original designed features before the workshop:

- Character can play certain instruments
- Game will have 3-5 venues and music genres
- There are 2 changeable set of instruments in each section, one originally used in the song and second set from another genre
- Player can select in which venue the band plays
- Characters have different clothing based on the music genre

Image 14. Screenshot from the game prototype that was used in the design workshops.

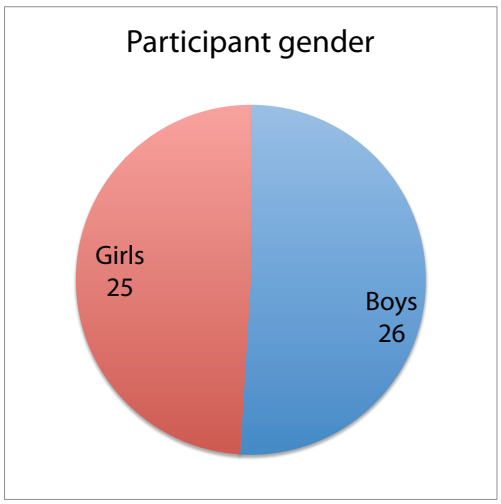
- Character can play a solo
- The song goes on as long as the player wants to
- There could be some kind of a achievement feature
- The game includes a parental section for instructions

3.1.2 Participants and setting

I contacted the kindergarten of Pajamäki about three months before the workshops. They were very helpful and interested to participate in this project. Before the workshops one meeting was held with the personnel to agree on schedule and other issues related to the arrangements. The workshops were held at the kindergarten premises during one week.

In total 52 children aged between 3 and 7 years from three daycare groups participated the design workshops. The participants included 25 girls and 26 boys. Most of the children were aged 5 and 6 years. One child couldn't focus to the workshop tasks so he is not included in the results. Some children didn't answer to all questions, these are marked as "blanks" in the statistics. It should be also noted that there was only two 7-year-olds, so their results should be considered only as directional.

The groups included one preschool (Huvikumpu, 14 kids) and two groups aged 3-5 years (Kesäkumpu, 18 and Melukylä, 20 kids). In the beginning I planned to have only the other group of 3 to 5 year-olds in the workshops due to time and resource issues, but in the meeting with the kindergarten teachers we agreed to take both groups in order to avoid jealousy and bad feelings between the groups. Permission to take part



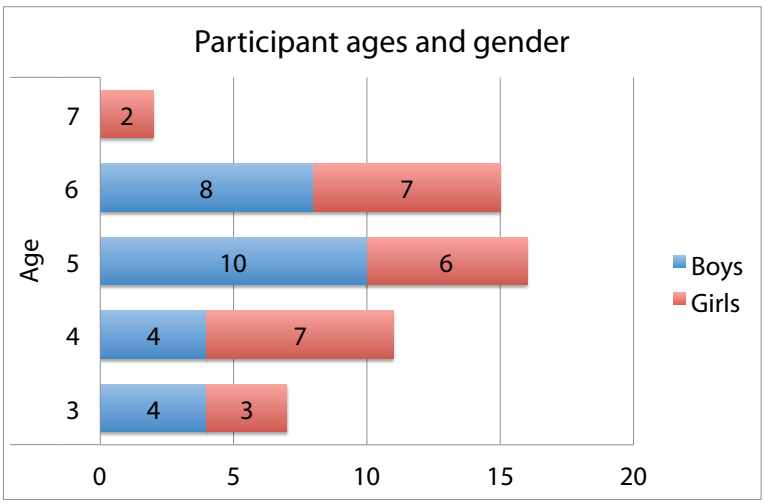
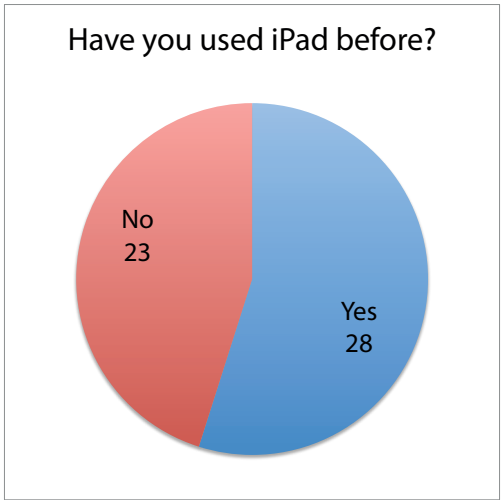


Chart 1. Participant gender.

Chart 2. Participant ages and gender.

in the workshops and to take camera footage from the participants was asked from the parents 3 weeks before the workshops. All children were given permit to take part in the workshops.

As background information we asked the participants had they used an iPad before. A bit over half had used an iPad before and most of the kids aged between 5 and 7 had used it before. It was noticeable that some children who had used an iPad before were more active when playing the game prototype and some children who had not used an iPad before were a bit more passive while playing the game in groups.



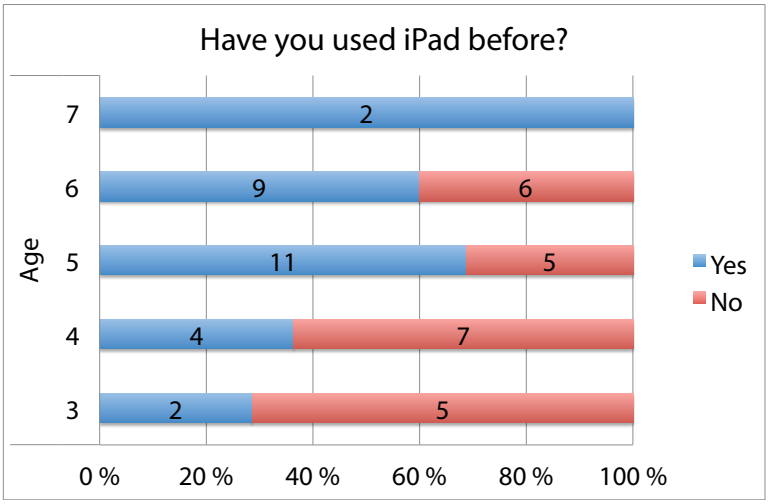


Chart 3. Amount of iPad users in the workshops.

Chart 4. Amount of iPad users by age.

The workshop schedule and content was planned according to the time restrictions the kindergarten's daily routines set to us. In the beginning when planning the workshop structure we were given about only one hour time each day in the morning when other children were playing outside. During that hour there was space and quietness inside the kindergarten and only the children coming to the workshop were invited inside. After adding the other group of 3 to 5 year-olds to the workshop participants the kindergarten staff cleared some more time for us from their afternoon routines.

The workshops were facilitated by me and Henna from the game team. Also the kindergarten teachers were present in the workshops and they helped us a couple of time to get the smallest children to listen to the instructions. My role was to be the leading facilitator. I did all the workshop planning and preparations and I led all the workshops. Henna's role was to facilitate half of the kids and help me in documentation while the children were doing design exercises. I prepared a structured form for

Image 15. Workshopping with preschoolers.

filling in the answers and other notes during the workshop (see appendix A for the query form). I also analyzed all the results after the workshops.

The workshops were held in different sized spaces in the kindergarten. Most of them were held in the children's own day care groups space. We had two tables, one for each group of 3 to 4 children. We all were in the same space so it was possible to give instructions at the same time to both groups.

I prepared materials for each group for the workshop sessions. It included documentation forms for writing down the answers and notes and material for design session such as game content as paper dolls and paper sheets, pens, glue and scissors. I also had two iPads for playing the game prototype and Toca Band for benchmarking. To keep the workshop sessions in schedule and to get attention from the children I had a reception desk bell. This worked as planned.

3.1.3 Workshop content and used methods

The workshops were held during one week (Monday 28.1.2013 to Friday 1.2.2013) at the Pajamäki kindergarten. The following describes the daily schedule and content of the workshops. Also the used methods are presented and the reasons behind the method choices are described. First the original plan is presented and then thoughts after the day with improvement ideas are presented.

Day 1 – "The play date"

The first day was for getting to know the children before the real workshop sessions. The main goal was to lower the possible tension and negative excitement of the children when doing things with a person they have not met before.

Henna and I went to the kindergarten for the whole day. The idea was to take part in the daily routines with the children one daycare group at a time. We were intro-

Image 16. Workshop package content: 2 iPads, documentation forms, paper prototyping and drawing materials and a reception desk bell.

duced to Kesäkumpu and Melukylä groups (3-5 year-olds) in the morning and to the preschooler group Huvikumpu (6-7 year-olds) in the afternoon. We took part in their morning circle where we were introduced and we had a brief chat with all the children about the workshop week. Then we took part in their playground activities outside by playing football and chatting more with them. The children were very interested about us and they were already throwing us ideas for the game even without seeing it.

After workshop analysis

Spending a day with the children before the workshops did help us to get the children to trust us. The workshops were possible to begin faster when the participants knew us. Also the designing session felt more relaxed than it would most like have been with out the "play date". There were a couple of very shy children to whom one day of getting to know them wasn't enough. The kindergarten teachers helped us to communicate with these most shy children.

Day 2 – "The dress rehearsal"

The second day we had the first design workshops. We started with the preschoolers because we thought that they would be easiest to work and communicate with than the younger children. In the afternoon we had one set of 3 to 5 year-olds.

The children were divided into groups of 3 or 4 by their kindergarten teacher. The goal was to have children who are good friends with one another in the same group. According to Druin (1999) the group dynamic is then better and the discussion be-

tween the children is more relaxed.

One workshop session was planned to last 45 minutes. Two groups of 3 or 4 children were in the room at the same time. One group was facilitated by me and the other by Henna. In the afternoon we had the first batch of 5 year-olds. 45 minutes was a bit too short with the preschoolers. They could have continued a bit longer and we needed to hurry up a bit in the end of the session. With the 5 year-olds the 45 minutes was a bit too long time and we skipped a couple of additional questions in the end of the workshop.

Each workshop session was divided into smaller tasks. Here are the original plans for each task and their after workshop analysis. The same structure was used also during the third and fourth workshop day.

Workshop introduction (5 min)

First we ask the children's names and have they used an iPad before. This information can be used when observing how they play the game – is an interaction or feature difficult to use or is the child only trying to learn how to use an iPad.

After this we explain to the children what are we going to do. By using the metaphor of baking cookies we explain how we are now collecting ingredients from them for our game and when mixing all the ideas together like cookie dough for doing a better game together. Metaphor is used for lowering the effect of egocentrism of younger children – the children might not understand that we cannot implement each and every idea they create for us but we will use a combination of all of them (Guha et al. 2004).

After workshop analysis

Shared introduction for both groups worked well with the preschoolers. They paid attention and the cookie story seemed to be a good idea to tell. With the younger children it was difficult to get both groups to listen at the same time, so it would be better to keep the shared introduction as short as possible and work all the time with small groups.

Play the game prototype (10 min)

Methods: Fun Toolkit, Contextual inquiry

Next the game prototype is introduced to the children. We will use Contextual inquiry and parts of Fun Toolkit to find out what they think of the game.

Before the game is played we show a printed image of the game and then ask the children to express their expectation of how fun they think the game will be through the Smileyometer (introduced in the Fun Toolkit chapter). Group facilitator will fill in the answers instead of the children themselves like described in the Fun Toolkit because of the age of the youngest participants. The children are asked to answer one by one in order to avoid the children to imitate answers from another.

Then we play the game within the group. We will follow how they play the game and what kind of comments they say to each other during playing according to the theory of Contextual inquiry.

After playing the game the Smileyometer is asked again so we will know did the game fulfill the expectations based on the looks of the game. Then we ask the chil-

Image 17. Boys playing the game prototype.

dren "Would you want to play the game again?" and fill in the answers to the Again Again table of the Fun Toolkit. Also additional question "Why would/wouldn't you like to play the game again?" is asked to get more insight to the children's thoughts about the game. All these questions are asked again one child at a time.

After workshop analysis

Smileyometer worked well for the purpose. In the 5 year-old group was one child who didn't speak much Finnish and he was able to answer to questions with the Smileyometer. By asking the children to answer one by one I think we managed to avoid mimicking the answers. Even though we asked had the children used an iPad before, it was a bit tricky to keep track who had used it before and who haven't while doing observations and notes during playing the game prototype.

We let the other children play the game during the questions. The younger children got a bit wild with the game and it was a bit frightening to leave them alone with the iPad while doing the interview one child at a time. It might be a good idea to finish playing the game before the questions and let the children do something else while they are waiting for their turn.

Designing a better game through playing (20 min)

Methods: Participatory design, Layered collaboration, Mixing ideas

As the design goal we will ask the children how would they make the game better? This can be elaborated by showing the biggest smile from the Smileyometer, how would we get there?

Image 18. Communicating through paper prototyping and drawing.

By lending ideas from participatory design, layered collaboration and mixing ideas we let the children create and communicate their ideas on top of the game graphics and characters through constructive and pretend play. We give the children prints of the game background (the venue) and the characters and instruments as cut out paper dolls. With additional material, paper, pens, glue, etc. the children can create new bits and pieces on top of the game world and show the needed interaction by playing with the paper dolls. The group's goal is to create one combined concept of the game's new features. This is documented by writing notes and also the paper prototypes and drawings made during the workshop are annotated.

After doing ideation in the groups of 3 or 4 we will do a brief wrap up. First the groups explain their ideas to the other group with the help of the group's facilitator. Then the groups can comment on each other's ideas and the discussion is documented by the facilitators.

Image 19. Collage by preschoolers (left) and a drawing by a 5-year-old (right).

After workshop analysis

There was a huge difference in the level of concentration between 6 and 5 year-olds. We were able to get day's best results from the preschoolers, but the used methods worked quite nicely with the younger children too.

Some groups started to draw right away and they had a lot of ideas to add to the venue, characters or instruments. It seemed to be natural to start playing with the paper dolls and adding new things to the game background for the preschoolers. The 5 year-olds ended up making full page drawings which was also a suitable way to communicate their thoughts. We didn't get any big ideas which would change the initial game concept. Maybe seeing the game prototype restricted their thinking and blocked the most wildest ideas.

After the drawings were ready we briefly shared the ideas between the teams. Due to running late in the schedule we decided not to try to combine the ideas of the two groups. The children did not have much to say about the other group's designs.

Benchmarking a similar game (10 min)

Methods: Fun Toolkit, Contextual inquiry

Image 20. Benchmarking Toca Band.

In order to get some reference how our game stands up against competition, we will introduce a pretty similar game to the children and do a similar session with it as we did in the beginning of the workshop with our game prototype. The benchmarked game is Toca Band where the player can select characters, which represent an instrument, to play on stage and make variations of one song (see the game description in the introduction chapter).

In the end of the session after using the Smileyometer and filling the Again Again table as we did with the game prototype we complete a Fun sorter table (part of the Fun Toolkit) where we ask the children the following questions:

- Which game was more fun?
- Which game was easier to play?
- Which game had better music?
- Which game had funnier characters?

The children are shown printed images of both games and they can answer to the question by pointing the images. The questions are asked one child at a time. To get more insight to the answers of presented comparative questions we will ask the additional question "Why that game was better?".

After workshop analysis

Going through the Smileyometer and Again Again questions after playing the game went fast because the children knew what to expect based on playing the prototype game before. We asked the Fun Sorter questions right away after the Smileyometer and Again Again table one child at a time. The additional question "Why?" gave us some results with the preschoolers but it seemed to be a difficult question for the 5 year-olds. Especially more abstract questions about the music and characters were difficult to most young children. We ended up skipping some of the why-questions in the end in order to speed up the pace.

Day 3 – "More routines"

Third day we had workshops with 3 to 5 year-old children in the morning. The workshop structure was the same as the day before. The workshops went better than the day before. The last group yesterday didn't had a nap so they were quite hard to handle. Maybe the children could concentrate better in the morning after a good night sleep. All the groups had 3 children so it was easier to work with them than with a group of 4 kids.

No big changes were made to the workshop structure. We agreed to use less time for the additional why-questions during the Fun Sorter questions as we noted the day before that it was difficult for the younger children to answer to open questions.

When having the ideation session it depended on the participating children how good results we got. For some it was difficult to come up anything and some kids didn't wanted to stop drawing new ideas.

When playing the game prototype and Toca Band some kids might have answered to the questions "How fun it was to play the game?" and "Would you like to play the game again?" negatively because some kids couldn't play the game as much as they would have liked to play. This is because the games were played together in a group and some children were more actively "hogging" the game. It would be better to let the children play the game in turns or in pairs.

During one designing session one boy wondered that how his drawings can end up in the game. Then we ended up cutting his drawing into pieces and gluing the pieces on the printed game background. That helped him to understand the concept of creating new ideas and combining those to existing parts of the game.

Day 4 – "Just a regular day at the office"

Fourth day was the last day for design workshops. No changes were made in the structure and the workshop felt like a routine performance. We had two sessions in the morning and one in the afternoon with 3 to 5 year-olds. This time the children in the afternoon session had taken a nap and similar concentration problems did not occurred as we had during the second day.

We had again a couple of groups of 4 children. It created some problems when playing the game prototype and Toca Band. We fixed the situation so that we let the children play the game one by one or in pairs. Some of the youngest children didn't wanted to answer to all questions. These blank answers were taken into account in the workshop results.

Day 5 – "Inspired by music"

The fifth and last day was reserved for the last design sessions one daycare group at a time. The goal is to go through the overall results with the children and let the children draw about the game prototype and sketch ideas for the missing fifth member of the band. We will have the sessions separately with all 3 daycare groups. One session lasts about 30 minutes.

In the afternoon all drawings are pinned on the wall and we will have an art exhibition. Every child can show and explain what she had drawn to workshop facilitator. We will play music from the game in the background during the exhibition and we will observe how the children feel about the music.

After workshop analysis

The kindergarten teachers suggested that we could play the game music while the kids were drawing. They have done this kind of "music painting" before. So we changed the plan and during the 30 minutes session we played the game music and the children draw. It was noticeable that especially the preschoolers had a hard time to start drawing new characters most likely because it had been already 3 days since they played the game. It might have been better to have this session during the same day as the designing workshops.

We didn't go through the overall results with the children. I didn't have the time to make a summary from the workshops so I decided to leave it out. We also skipped the pinning of the drawings due to scheduling challenges. Instead the children presented their drawings one by one and we filmed the children whose parents allowed filming. We asked the children to give a name to their characters, but only a few could think of a name. We also observed the children when the song changed in the background while they were drawing and made notes about the reactions.

3.2 Workshop results

Workshops goal was to get ideas for new game features and characters. We also aimed to compare the game prototype against the Toca Band game to get some kind of a reference point so we could compare the results for our game to something tangible.

I think the workshops were successful. Most of the ideas we got from the children were small additions to the game prototype graphics. The children also told some incredible stories and funny accidents. Also observing the children while playing the games provided good insight how children between 3 and 7 years behave and how do they see the world and what things makes them laugh. All these pieces of information worked as an important source of inspiration when designing new features for the game.

The workshops provided both qualitative and quantitative results. This chapter describes how the results were first analyzed and the results are presented by following the workshop structure. The main focus was in the qualitative results and since these results are only to guide this particular design process, statistical reliability of quantitative differences is not calculated for any of the results.

3.2.1 Analyzing results

Each day after workshops the documentation forms were typed into an Excel sheet. The Excel sheet had one row for one child's answers and the workshop structure and questions were in the columns. By using filtering features the raw data was analyzed into charts. The charts present the results by the age and gender of the children. It would have been also possible to analyze the data according to had a child used an iPad before or not, but from the game design point of view it felt unnecessary because we focused more to find the appropriate age group for the game and see if the design was suitable both to girls and boys.

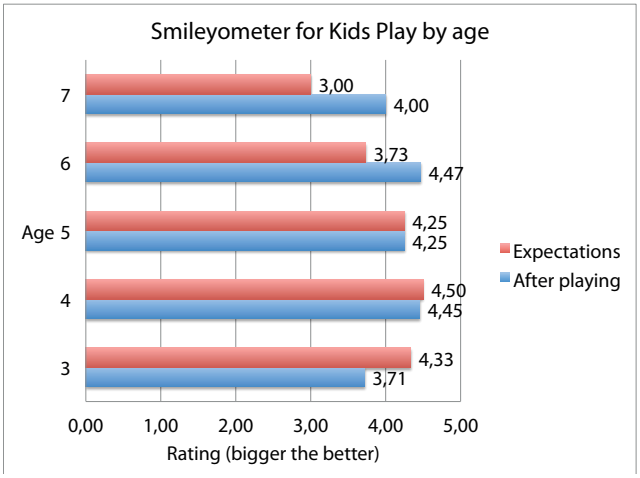
Playing prototype				
Smileyometer A - How fun the game will be based on picture?	Comments during playing	Smileyometer B How fun the game was?	Would you like to play the game again?	What was the best / worst thing?
3	"This is quite good and funny." It seemed that he enjoyed searching which instrument belongs to which character.	5	Yes	"It was great that you could have any kind of band combination."
4	Electric bass made her giggle.	5	Yes	
5	"How can you give the instrument?" He seemed to enjoy listening to single instruments.	5	Yes	"It was nice to make them play"
4		5	Yes	"Playing music"

Table 4. Workshop results structured in an Excel file.

During the design workshops and the fifth day's large group sessions we got 107 drawings and paper prototypes from the children. First of all the drawings worked as a method of communication during the workshops. On top of this all drawings were coded to what they represented and these results were grouped based on different categories that were possible to detect from the results. The found categories were *character, instrument, venue, action* and *miscellaneous*. Most of the drawings were small additions to the original game background and characters. Children also draw quite many new instruments to the characters. On top of looking at the drawings as source of qualitative results the coded results were also transferred into word clouds for quick quantitative analysis. This was done for looking the right focus for the design.

3.2.2 Playing experience

Smileyometer was used for rating the gaming experience. First the children rated the expectations based on a static image of the game and the real playing experience after playing. This was done both to the game prototype and Toca Band.



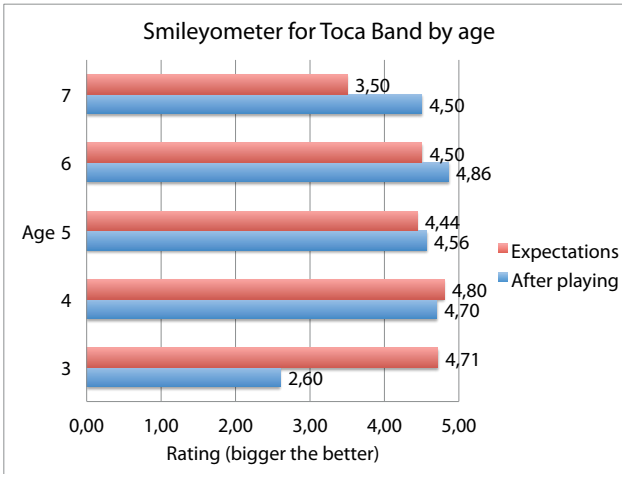


Chart 5. Game prototype rating by age.

Chart 6. Toca Band rating by age.

There were no huge differences in results between age groups. 4 year-olds had the largest expectations based on the game image, and after playing the rating dropped a bit. 6 and 7 year-olds had the largest positive difference in results after playing the game. The big drop in the 3 year-olds expectations and after playing experience in both the game prototype and Toca Band results can be partly explained by the fact that some of the children couldn't play the games as much as they would have liked to play. Therefore the overall gaming session could have been a negative experience even though the game itself was fun.

When looking at the results by gender boys seemed to enjoy the game a bit more than the girls. Girls had lower expectations and had a larger increase in the rating after playing. Overall the prototype was experienced to be better after playing than expected and both girls and boys enjoyed it.

When comparing the prototype to Toca Band, the rating is higher for Toca Band. One reason for this can be the fact that Toca Band was a finished game and the prototype was still lacking features and final polishing. What is most interesting in the Toca Band results is that in overall it got lower rating after playing than expectation rating. Girls seemed to enjoy it more than boys.

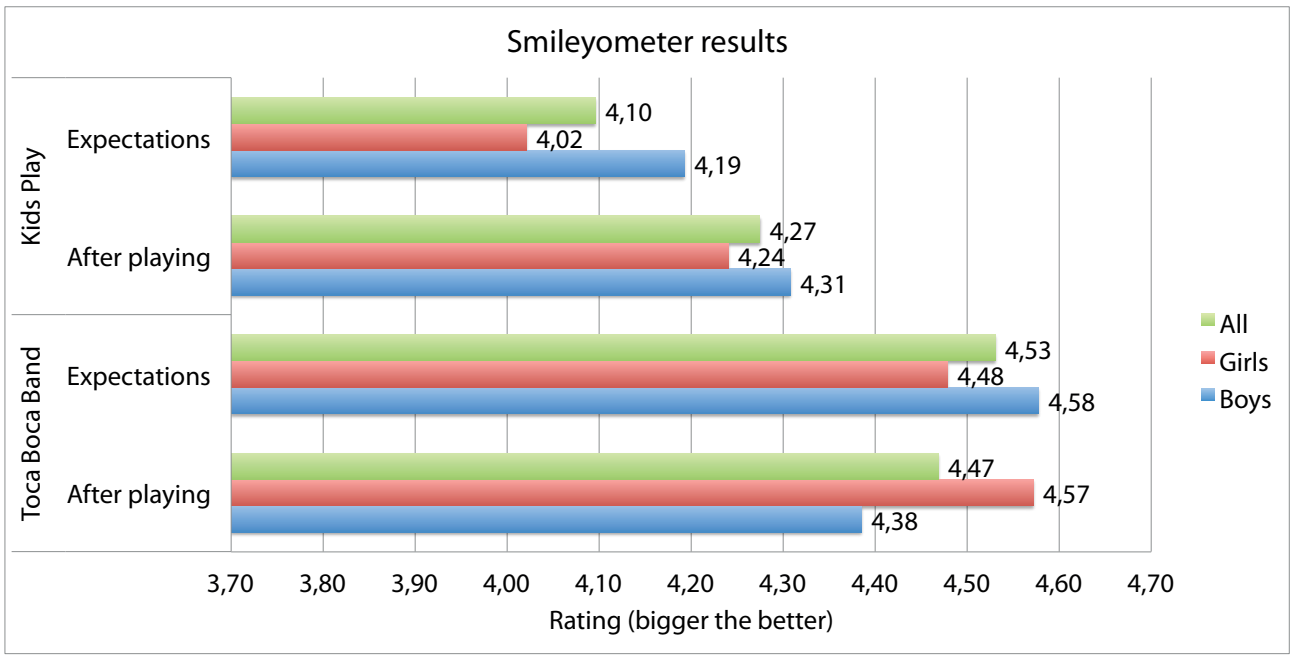


Chart 7. Game expectations and after playing experience by gender rated with a Smileyometer.

"Let's dance!"

-Girl, 5 years, while playing the game prototype

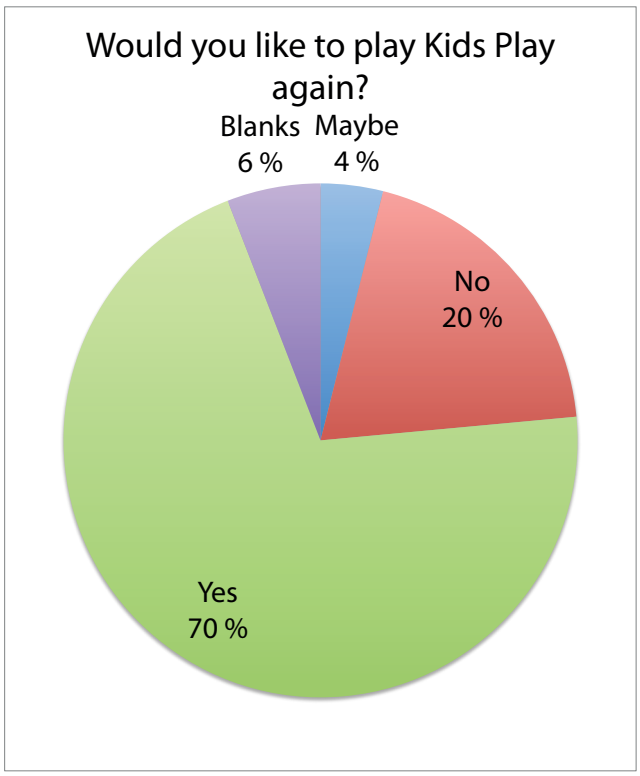
The children were observed while they were playing and notes were taken from their comments and behavior. We didn't have time to implement any visual hint which instrument belongs to which character in the game prototype. Also the interaction of dragging an instrument to a character was still a bit rough. This caused frustration to most kids. It seemed that still most kids enjoyed finding the correct instrument-character pairs and changing the instruments. After finding the correct pairs a couple children stopped playing and wondered what should be done next. After giving a hint that you could change the second set of instruments to the characters they continued playing. In overall the children seemed to enjoy playing the prototype, but it was quite clear that it still lacked features to keep the children interested for longer time.

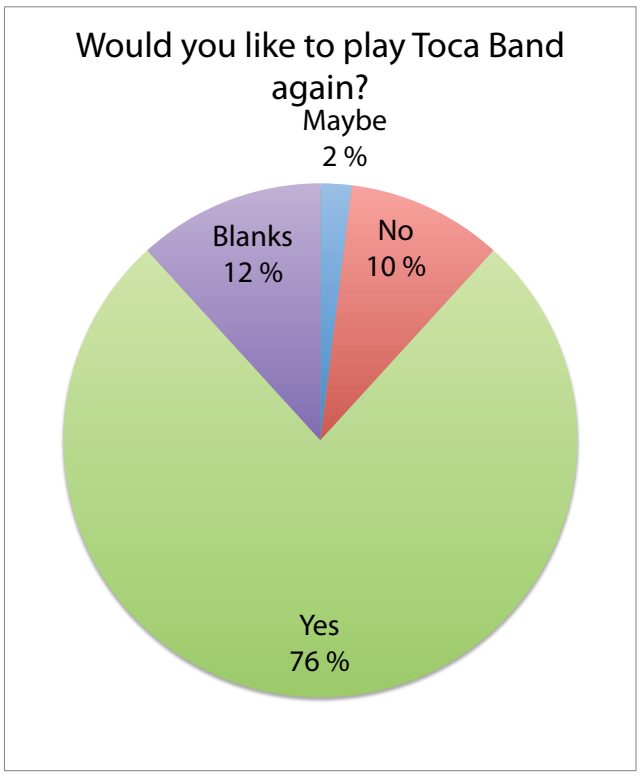
"This has the Talent show star!"

-Girl, 4 years, while playing Toca Band

Multiple animated characters, funny sounds and playing an instrument in solo mode were the most liked features in Toca Band. Also the Toca Boca animated logo in the game loading screen made almost all children laugh. One girl recognized the brand to be the same as in most of the games as in her father's iPad. One reason why girls enjoyed the game more than boys could have been the element of stardom when dragging a character to the star in to star the solo feature. This let the player to pretend of being a star for a moment and really play the instrument. The other side of this was that when the player was able to play the instrument it usually ended up as uncontrolled noise, which didn't had anything to with the background music. Also the human voice characters were played often and human sound and singing was something that was missing from the game prototype.

After playing both games the kids were asked "Would you like to play the game again?" The goal of this question was to get overall insight did the children enjoy playing the game so much that they would like to keep on playing it again.



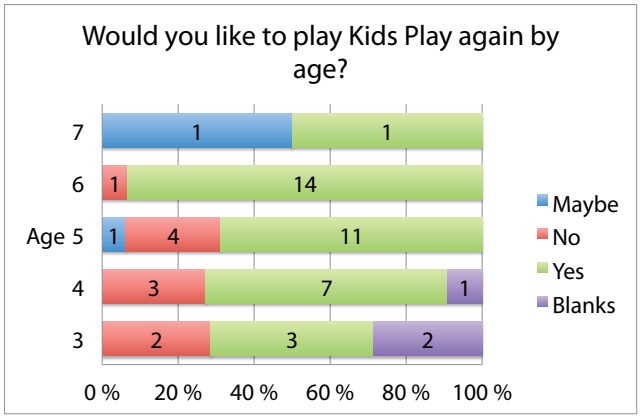


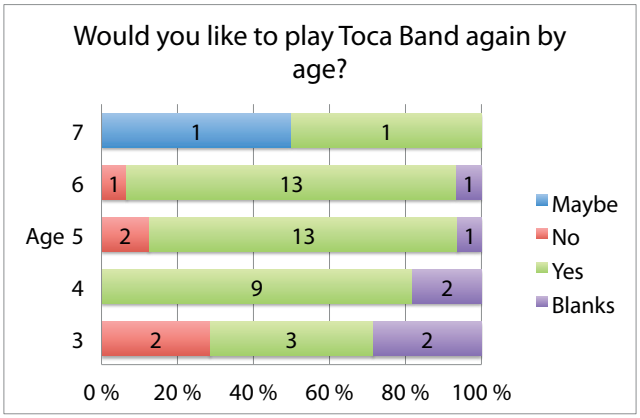
In overall 70 % of the children would like to play the game prototype again. This is slightly less than Toca Band's 76 %, so the result is comparatively good. The reason for the amount of blank answers in the Toca Band's results is that Toca Band was played in the end of the workshop and some younger children couldn't concentrate in the questions anymore.

Chart 8. 70 % of all children would like to play Kids Play prototype again.

Chart 9. 76 % of all children would like to play Toca Band again.

When looking at the results by age, it seems that both the game prototype and Toca Band were favored most by 6-year-olds. Based on these results the younger children's needs should be taken into extra consideration when designing new features into the game.





When looking at the results by gender it seems that girls preferred both games a bit more than boys. This is not totally in line with the game prototype Smileyometer results, where boys gave bit better ranking. It also needs to be noted that 20 % of girls left the question unanswered and therefore the result is only directional.

Chart 10. How many children would like to play Kids Play prototype again by age.

Chart 11. How many children would like to play Toca Band again by age.

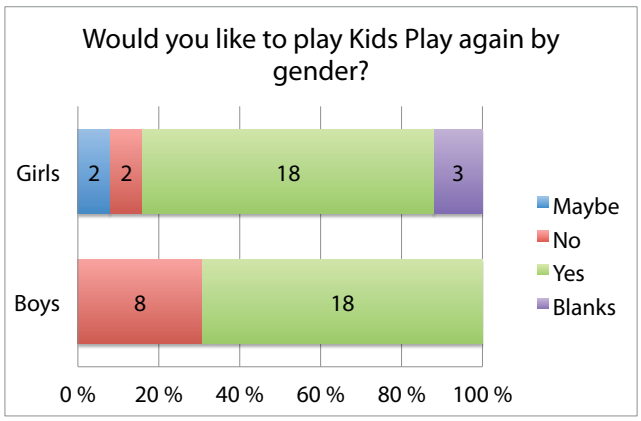


Chart 12. How many children would like to play Kids Play prototype again by gender.

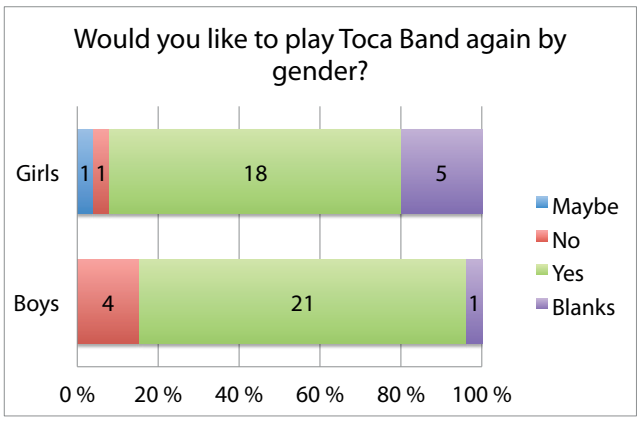


Chart 13. How many children would like to play Toca Band again by gender.

"It was great that you could have any kind of band combination."

-Boy, 6 years, after playing the game prototype

When asking the children what was the best or the worst thing in the game, the most common answer was that they liked the music and giving instruments to characters and mixing different genre instruments, but they would have liked to do more things. Also it was difficult to find the correct character-instrument pair which lowered the prototype's points.

"The spider did a funny sound."

-Girl, 4 years, after playing Toca Band

In Toca Band the kids enjoyed mostly the lively and funny characters and the solo play feature. Also the singing characters were liked. It seemed that the sillier character or sound, the more it was liked by the kids.

3.2.3 Designing new features

After playing the game prototype the groups of 3 to 4 kids had a designing session which goal was to create ideas how the game could be better. The children used the material provided to them (game as paper dolls, drawing paper, pens, glue, scissors, etc.) to express their thoughts. Some groups, especially the older preschoolers, created collages where all the group's ideas were combined. The younger children found it more natural to create full page drawings.

The collages and drawings worked nicely as a communication tool when the children explained their ideas. The children also expressed their ideas just by telling about them during the design session and these ideas were written down by the facilitator.

"You should be able to turn the volume so high the house explodes."

-Boy, 6 years, when creating new ideas for the game

The overall results suggested that there should be more of everything in the game – more instruments, more ornaments in the venue backgrounds and more surprising and funny action. Also the fact that there wasn't any animation in the prototype

Image 21. Creating a combined idea collage.

was noted. The kids hoped the venue would have more things that are more related to their own activities, e.g. the park venue should be a playground park. It was also expressed that it should be possible to move the characters more freely around the venue.

Afterwards every collages' and drawings' contents were coded into an Excel sheet for quantitative analysis. The results were categorized to *character, instrument, venue, action* and *miscellaneous* as stated earlier. Also a word cloud was created to quickly visualize the quantitative results.

From the word cloud it is easy to spot which characters (bunny and bear) and instruments (guitar and piano) were children's favorites. It is also noticeable that the children would like to have a singing character and most of the electronic instruments were found funny. We got also already a bunch of character suggestions even without asking for those. Some drawings had nice combinations of content and action like a robot who plays scissors and makes *"swoosh, swoosh"* sounds. Also surprising ends to the band's show was suggested, e.g. a storm comes and the characters are going around and around inside the tornado.

The design session didn't really offer too many new feature suggestions. All things were more or less related and restricted to the game prototype's background and content. Anyway the drawings can be used as a source of inspiration when designing more features to the game with the game team.

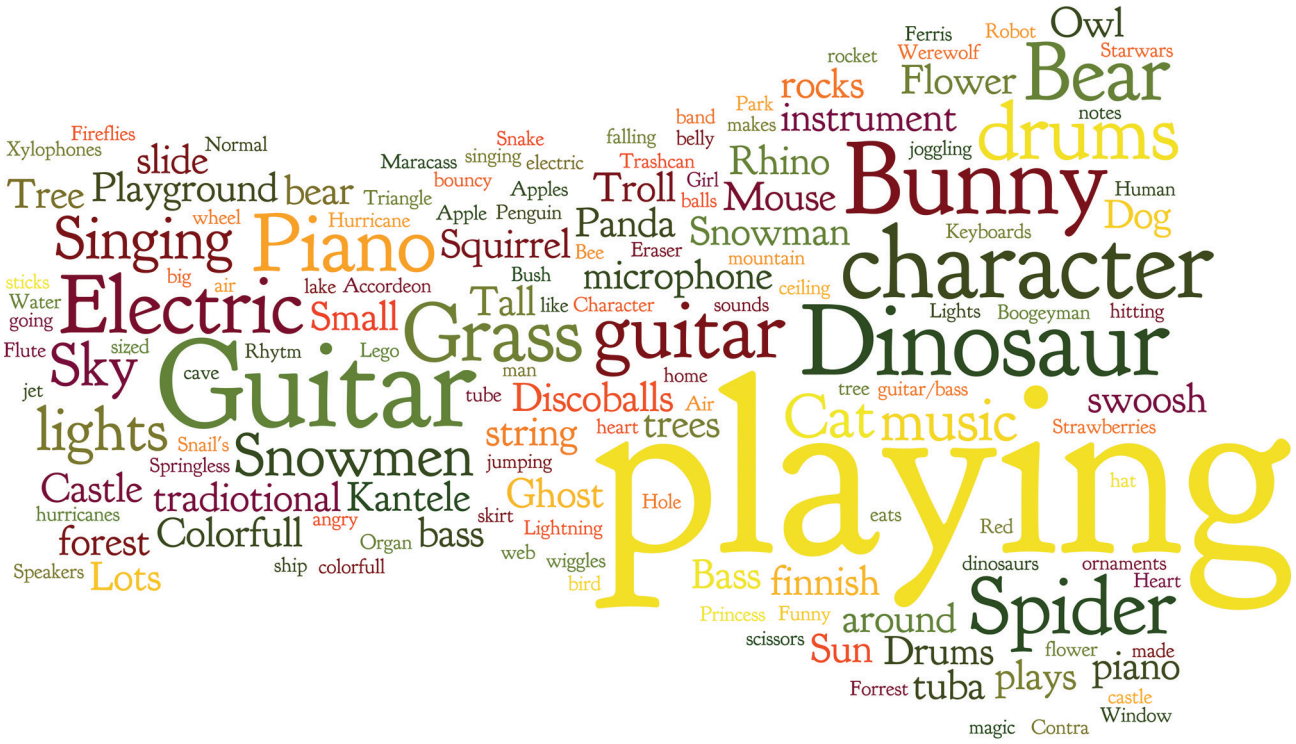


Image 22. Content of the workshop collages and drawings (created with wordle.net).

3.2.4 Which game was…?

After playing Toca Band the children were asked one by one a set of Fun Sorter questions. The idea was to compare the game prototype and Toca Band and see which one the children liked more. In general the children liked the Toca Band more in every question. It needs to be noted that Kids Play was just an early stage prototype and therefore it most likely had an influence to the results compared to Toca Band.

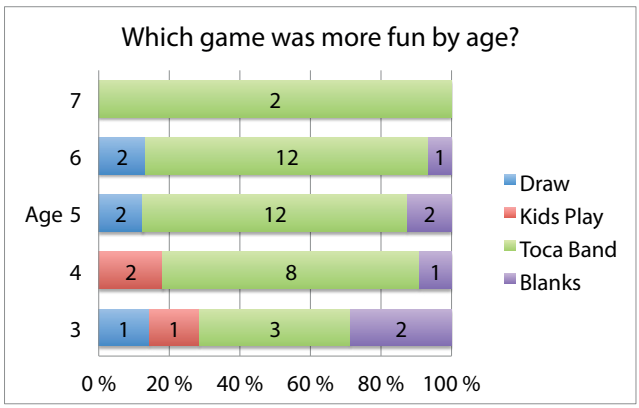
It would be interesting to conduct the same Fun sorter with same aged children as in these workshops after the prototype is further developed and when it contains more finalized features. The Fun sorter would work nicely for comparing two or several early stage game concepts to get insight which concept would be the best to develop further.

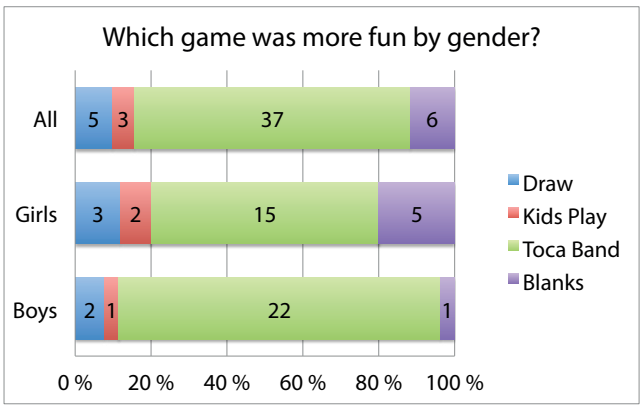
"It had more music players and they were characters not instruments."

-Boy, 6 years, why he liked Toca Band more than Kids Play

When looking at the results from the prototype point of view, it won most votes from 3 and 4 year-olds. Also in these results more girls liked the prototype over Toca Band than boys.

After asking the main Fun Sorter question each child was asked to tell why she liked the other game more. Toca Band was mostly the favorite, because it allowed to put the characters anywhere in the stage and in the prototype you needed to find the correct character. Also the solo feature was mentioned in many answers.





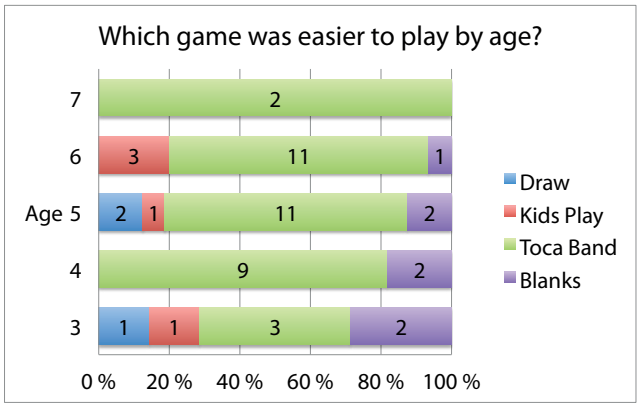
"You can put characters everywhere."
-Girl, 7 years, thinks Toca Band was easier to play

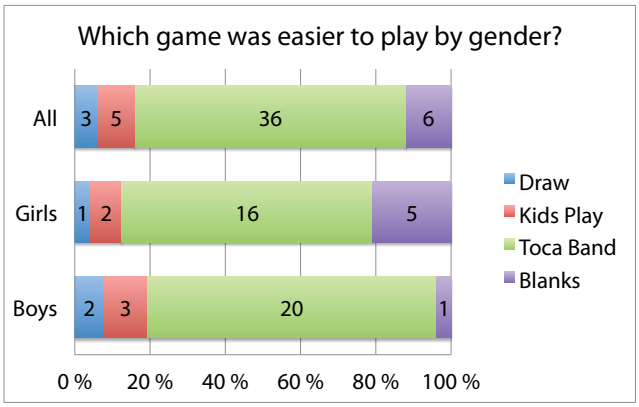
Chart 14. Which game was more fun by age?

Chart 15. Which game was more fun by gender?

In overall Toca Band was experienced to be easier to play than the game prototype. There is a bit of variance in the answers by age, a few 6 and 3 year-olds and none of the 7 and 4 year-olds thought the prototype was easier to play than Toca Band.

Most of the comments were related to that you could move the characters freely in Toca Band. Some commented that the prototype was easier to play because it had less moving objects and you didn't need to play the instrument as you needed in the Toca Band's solo feature.





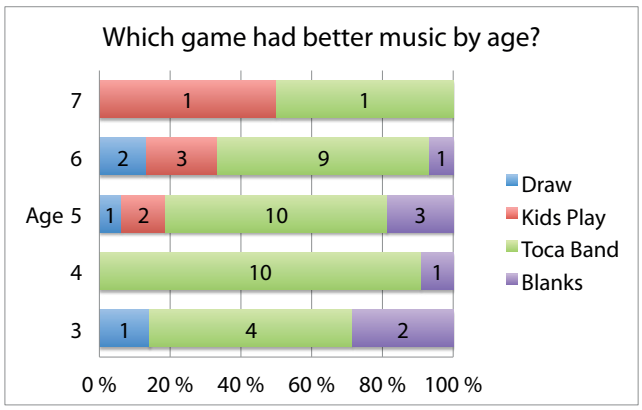
"It plays the same song even if you change the instrument."
-Boy, 6 years, why game prototype's music was better

Chart 16. Which game was easier to play by age?

Chart 17. Which game was easier to play by gender?

When asking the children about the music it seemed that especially for young children it was a difficult question maybe because music is quite abstract. The game prototype got the best results when comparing the game music. It seemed that the older children liked more our music than the younger ones. There wasn't a difference between answers by gender. This was a positive result in that sense that the game team's goal was to differentiate the game from the competition with unique music. Getting some positive feedback in an early prototype stage is a proof that we are going in the right direction.

Some children said to like more the prototypes music because it sounded nice and funny. Toca Band got more votes mainly because it had singing characters. In the end it felt like when we talked about the prototype the kids talked about music and when asking about Toca Band they talked about sounds and funny characters. This is



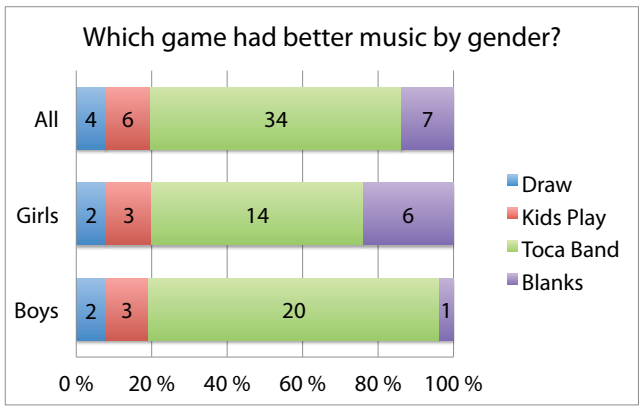


Chart 18. Which game had better music by age?

Chart 19. Which game had better music by gender?

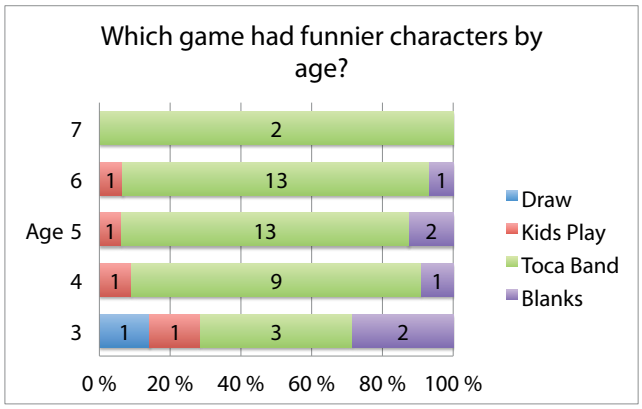
one important design issue that looks promising from the prototype's point of view.

"Funny looking characters. The rap singer was best."

-Boy, 6 years, why he liked Toca Band's characters more

In the end we asked the children which game had funnier characters. Now when thinking about the question afterwards it might have been better to ask which game looked nicer. Then the answers would have focused more in the overall appearance of the game than only the characters. The game prototype got some points from the younger children. There wasn't a big difference between the genders.

The comments about which characters were funnier were mostly about Toca Band. The character were nicely animated and made funny things. Those were most likely the main reasons why Toca Band was liked more in this category.



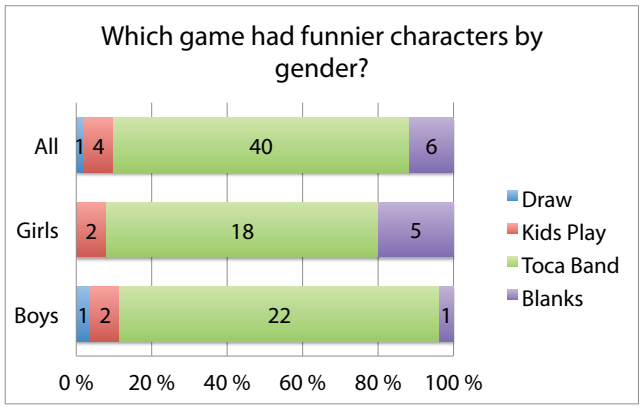


Chart 20. Which game had funnier characters by age?

Chart 21. Which game had funnier characters by gender?

3.2.5 Drawing characters

In the last day of the workshop series the children were asked to draw a fifth character to the band in the game prototype. While the children were drawing music composed for the finalized game was played in the background to give the children inspiration for the character. When the drawing was ready the content of the drawing was presented one child at a time.

All drawings' content was coded into an Excel sheet in the same way as drawings from the design workshops. Also a word cloud was created for a quick visualization of the quantified data.

Image 23. Boy explaining his character design.

The most common characters, excluding the ones already in the prototype, were penguin, spider, fox, cat, dinosaur, butterfly and mouse. Some drawings also included human characters. We had some "duplicate" drawings that were created by children sitting next to each other. Especially the preschool group seemed to have a lot of mimicked characters. The reason for this most likely was that it was already 3 days when they played the game and they seemed to have some troubles getting started with drawing.

Image 24. Content of the character design drawings (created with wordle.net).

"This is a good song!"
-Boy, 5 years, while listening to electric music

While the children were drawing they were observed did the music played in the background had any kind of effect to the children. Some of the children recognized the Balkan beat song that was in the game prototype and started moving to the music. One boy started even to play "air accordion". Electronic music created the most reactions and some kids were moving to the beat. When the song got more complicated interest got lower. In overall it seemed that all music had a positive effect to the children. This was a simple and quite efficient way to test game music and to get some feedback.

3.3 Using the results in game design

After the design workshops with children I analyzed the results and presented them to the rest of the game team during a full day workshop. The goal was to design rest of the game features based on the children workshop results. I prepared and facilitated the workshop. In this chapter I describe my conclusions based on the workshop results and how the results were used with the game team while designing the finalized game features.

Based on the observations made during the workshops I found the following themes for game content and features which I believe are key success factors for making Kids Play a better game:

- Abnormalities
- Achievements
- Funny failures
- Stardom / Pretend play
- Surprises

Abnormalities are things, which are different, or opposite to what the children think is normal. For example playing music with objects that are not instruments or making a very small character play a huge instrument. Idea for this came from the absurd stories and drawings the children made. Playing a base made from a Springles chips tube or a band of fireflies playing big instruments.

A game should have *achievements* so that the player gets some kind of a reward or notification for doing the right things in the game. This doesn't necessarily mean collecting points, it could also be getting badges for using certain features in a correct way. The key is to get the feedback loop as clear and rewarding as possible. Some of the children stopped playing the game prototype after they had found correct instruments for each band member. After giving them a hint that they could try also the other instruments got them to try different instrument combinations. This was a clear indicator that some sort of clear achievements and goals are needed in the game.

The children felt like failing when they couldn't find the correct character to play an instrument. This happened because the game didn't give any kind of feedback to the player. By giving the player a clear feedback that what you just did wasn't correct and especially communicating this is a funny way, as a *funny failure*, could transform failing to be fun and an important part of the whole playing experience. Also Will

Image 25. Brainstorming with the game team.

Wright, the game designer of the SimCity and the Sims, has told that if you can make failure a big part of the entertainment value of the game, people can get a blast out of it (Moggridge 2007, pp. 377-378). For example like when kids build a block tower and then smash it down laughing.

Children loved the solo star in Toca Band. All of them didn't even care too much about playing the instrument in the solo feature, the idea of putting your favorite character on a shooting star and flying above other characters was rewarding enough for many, especially girls. To me it looked like they pretended a moment of stardom through the character. By adding *stardom* or *pretend play* features to the game should make it especially appealing to girl players.

One idea that was presented in the design workshops was to have boxes in the game and by touching them a new instrument would pop out. Also the idea of a sudden tornado swiping the band members away goes to the surprise theme. By including *surprise element* for example to the achievement and rewarding cycles would most likely add positive excitement to the game especially for the youngest players.

These five themes were used as a way of categorizing new designed game content and feature ideas during the game team workshop. It allowed us to focus on one theme at a time and gave a nice structure to the brainstorming session.

After the brainstorming session we designed a game flow with all needed game views and transformations between them. The content of each game view was reflected to the results of the brainstorming session and suitable features and content was included into different parts of the game flow.

Image 26. Designing the game flow.

The children's drawings were used as a source of inspiration in the beginning of the workshop. It felt a bit unnecessary go through them one by one so I laid the drawings around the space so we could have a gallery walk around them.

When looking back at the original game design and the design we ended up after the workshop most likely would have not been as good as now when we included children in the design process. Otherwise we would have designed the game only through our own adult eyes and totally missed the view how things looks like one meter lower.

Image 27 (1650). Children's drawings around the workshop space.

People play to learn as well as to have fun, but they stop playing immediately if the toy or game gets boring. Toys and games are designed for enjoyment, to give rewards of pleasure and entertainment from the moment that they are first encountered to the day they are discarded. That presents a rigorous discipline for the designers and implies that we have a lot to learn from understanding how to design interactive play.

Bill Moggridge, founder of IDEO
(Moggridge 2007, p. 321)

4. Conclusion

The main design goal of this project was to find answers to the following questions:

What kind of design collaboration should be included in a design process when developing a touch screen game for young children?

What kinds of design and research methods are suitable when working with children?

What kind of results can be expected from design sessions when working with children and how these results can be used with the game development team?

Literature study was conducted to subjects of children's cognitive development, children's different roles in design processes and design and research methods where children are an essential part of the products design process. Based on the found material a detailed structure for a 5-day workshop session was planned. Some changes to the original methods had to be made, because the available timespan was shorter and the participating children were partly younger than the ones the methods were created and tested with.

Design collaboration

The children participated in one phase of the design process as informants. During 5 days they tested the Kids Play prototype, answered interview questions, created new ideas for the game and benchmarked another iPad game. Some design choices were left open on purpose before the workshops and the final design was based on the workshop results.

Methods used

The methods used seemed to be suitable for designing with young children. Especially the use Fun Toolkit provided good results. The Smileyometer was a good tool for communicating with young children and also with immigrant children who didn't speak fluent Finnish. When asking the Fun Sorter questions it is advisable to show images of the answering options. In our case answering was made easy to the children by letting them point game screenshots.

In the design sessions parts of the Cooperative inquiry methods were used. Contextual inquiry was the basis for observing and interviewing the children during and after playing games. Participatory design inspired the way children were instructed to create new ideas for the game. The ideas were created within small groups and some end results were combined collages from individual ideas done in a similar way as described in the Mixing ideas method. The role of Layered collaboration was smaller than originally planned, because we ran out of time during the sessions. In overall communicating through drawing was a powerful communication method. It helped especially the youngest children to communicate their ideas.

The results

The workshop week resulted in qualitative and quantitative results. The qualitative results were related to new ideas and features. Also observing the children's behavior while they played the Kids Play prototype and benchmarked game Toca Band gave good insight about young children's way of thinking and viewing the world. In overall

the workshops provided less results than expected which would have given concrete ideas for new gameplay or larger features. Children concentrated mostly on adding things to the game graphics. This most likely occurred because we tied the workshop content to the game prototype and this might have restricted the children's thinking.

The quantitative results related to evaluating the game prototype and comparing it against a competing game. All results were analyzed based on age and gender of the children. Based on this the game was most liked by 4 to 6-year-olds and girls seemed to enjoy it bit more than boys. Kids Play prototype lost to Toca Band in every of the comparing questions, but one must keep in mind that our game was only a prototype. To get more insight the same questions should be presented later when Kids Play has more features. Analyzing the children's drawings was quite tricky. I ended up to quantify the drawings' content and to get some insight by creating word clouds from the data. The drawings were mostly used as a way of communication during the workshops and a source of inspirations for the whole game team.

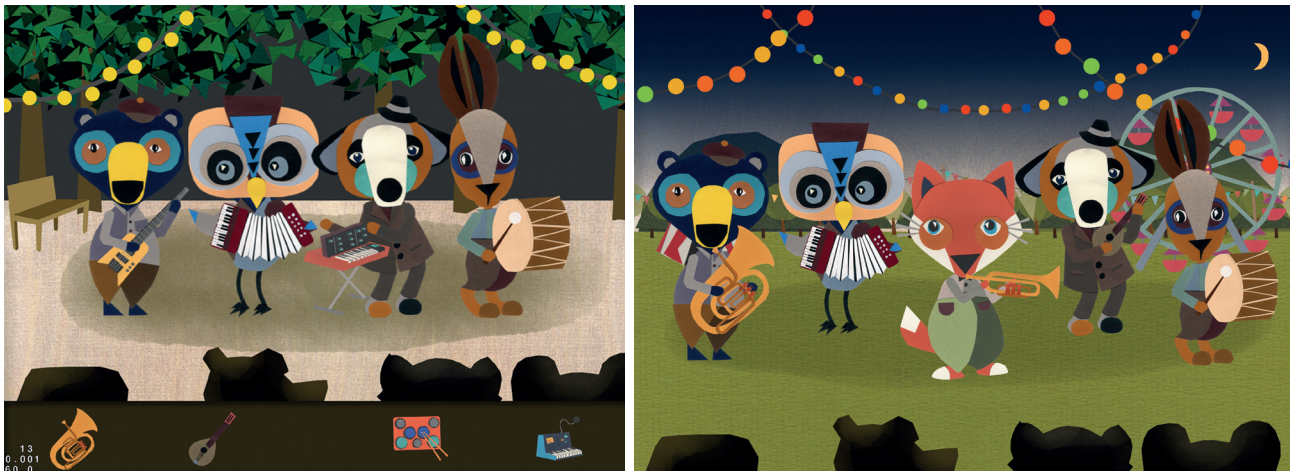


Image 28. Game venue design before and after inspired by the design workshop results.

In overall the biggest value of organizing the workshops was to be able to "go inside" of 52 children's minds. Observing them while they were playing and seeing what is interesting to them and makes them laugh was very important source of insight and inspiration when the game design was continued after the workshops. Based on this knowledge the following key game elements themes were formed:

- Abnormalities
- Achievements
- Funny failures
- Stardom / Pretend play
- Surprises

These themes were used as the basis for further game design work. The overall game concept was reformed and new features were designed. I as the lead designer feel that the overall game design would have not been a success in a commercial point of view if the game development would had been finished without the knowledge obtained from the co-creation workshops.

Lessons learned

The amount of participated children could have been smaller. Due to politeness I ended up with a group of 52 children. During the last day it started to feel that the results were starting to repeat. I feel that it would have been possible to get similar quality results with around 20 children.

The results gotten from the Fun Sorter questions were not very reliable because the children compared a prototype against a full game. Another round of query is needed after the Kids Play game has more features. Then the games will have a fair fight. Also then the more final results can be used to measure was the design work done after the workshops successful or not.

I got some critique during the master thesis seminar for leaving music theory out of the thesis' scope. I left it out intentionally because the game team includes two music experts and I as the producer of the game wanted to trust the responsibility of dealing with music to them. It might have been a good idea to have a look at the theories of how music is experienced by young children in the very beginning of the game concept design. I still think that the current game concept is going to be a successful one.

Next steps

The game project will continue with a refined game design and new features designed based on the workshop results. Also co-creation will continue with the children's parents as soon as the game is developed to a beta version. The parents, who own an iPad, are provided with the game beta version and they will be asked to send feedback. Also I have planned to open a discussion forum where the parents can share their ideas with other parents.

I am also planning to visit the kindergarten once more when the game is nearly finished. I will conduct user tests and also the second round for the Fun sorter questions is possible to do then. Although it could be better to have the comparative results from children who haven't seen either of the games before. After this it is still possible to do final changes to the game before it is published.

If there is going to be a next children's game design project in the future, I will try to make it closer to a real participatory design process. I believe that children could provide nice alternative game concepts if they are included in the beginning of the process as design partners instead of being informants as in this project.

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RYHMÄ				
Nimet				
Onko iPad tuttu?	Kyllä Ei	Kyllä Ei	Kyllä Ei	Kyllä Ei
Proton peluu				
Smileyometer A	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺
Pelin aikaiset kommentit				
Smileyometer B	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺
Pelaisitko peliä uudestaan?	Kyllä Ehkä Ei	Kyllä Ehkä Ei	Kyllä Ehkä Ei	Kyllä Ehkä Ei
Mikä hyvää / huonoa?				

Ideointi	
Tilaa muistiinpanoille	

Toca Boca Band				
Smileyometer A	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺
Pelin aikaiset kommentit				
Smileyometer B	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺	☹ 1 2 3 4 5 ☺
Pelaisitko peliä uudestaan?	Kyllä Ehkä Ei	Kyllä Ehkä Ei	Kyllä Ehkä Ei	Kyllä Ehkä Ei
Mikä hyvää / huonoa?				

Fun sorter

Kumpi peli oli hauskempi?	Meidän Toca	Meidän Toca	Meidän Toca	Meidän Toca
Miksi?				
Kumpaa oli helpompi pelata?	Meidän Toca	Meidän Toca	Meidän Toca	Meidän Toca
Miksi?				
Kummassa oli parempi musiikki?	Meidän Toca	Meidän Toca	Meidän Toca	Meidän Toca
Miksi?				
Hauskemmat hahmot?	Meidän Toca	Meidän Toca	Meidän Toca	Meidän Toca
Miksi?				

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